EXAMINER'S SEARCH NOTES

US 20030208365A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2003/0208365 A1**

Avery et al. (43) **Pub. Date: Nov. 6, 2003**

(54) **ON-LINE DESIGN OF DISTRIBUTION TRANSFORMERS**

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(21) Appl. No.: **10/297,877**

(22) PCT Filed: **Dec. 27, 2000**

(86) PCT No.: **PCT/US00/35268**

Related U.S. Application Data

(60) Provisional application No. 60/173,394, filed on Dec. 28, 1999.

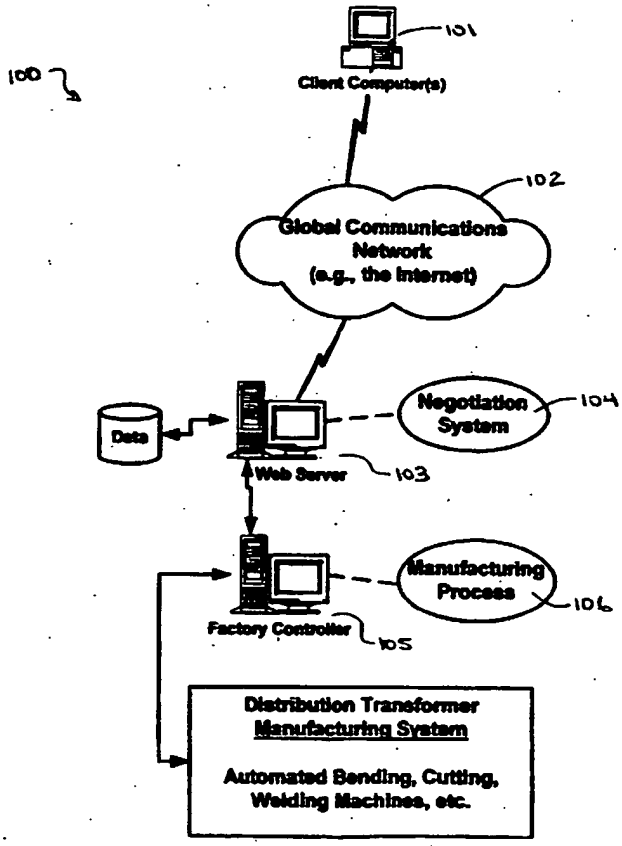
Publication Classification

(51) **Int. Cl.**[7] **G06F 17/60**

(52) **U.S. Cl.** **705/1**

(57) **ABSTRACT**

An improved system and method for the production of transformers, such as small, simple pad mounted distribution transformers is described. An external user (**101**), e.g., a customer or a field sales person, is permitted to orchestrate the entire negotiation and production process (**104**) to meet his or her specific requirements. The user is able to submit orders, review scheduling, and receive confirmation of the manufactures of the transformer over a network (**102**), such as the INTERNET. In the background, the manufacturing process (**106**) is preferably automated (**105**) to minimize the cycle time and the number of people required to satisfy the user's requirements. The transformer ordering system can be integral in designing and ordering high quality distribution transformers. In a preferred embodiment, it uses interactive tools (**101, 103, 105**) to assure quick and knowledgeable design and ordering of distribution transformers. The transformer ordering system and method go beyond the traditional sales and manufacturing, etc. before a Request for Quote (RFQ) is generated. This system can be partnered with other design and ordering systems to provide full service ordering, or it may be a stand-alone INTERNET-based ordering system.



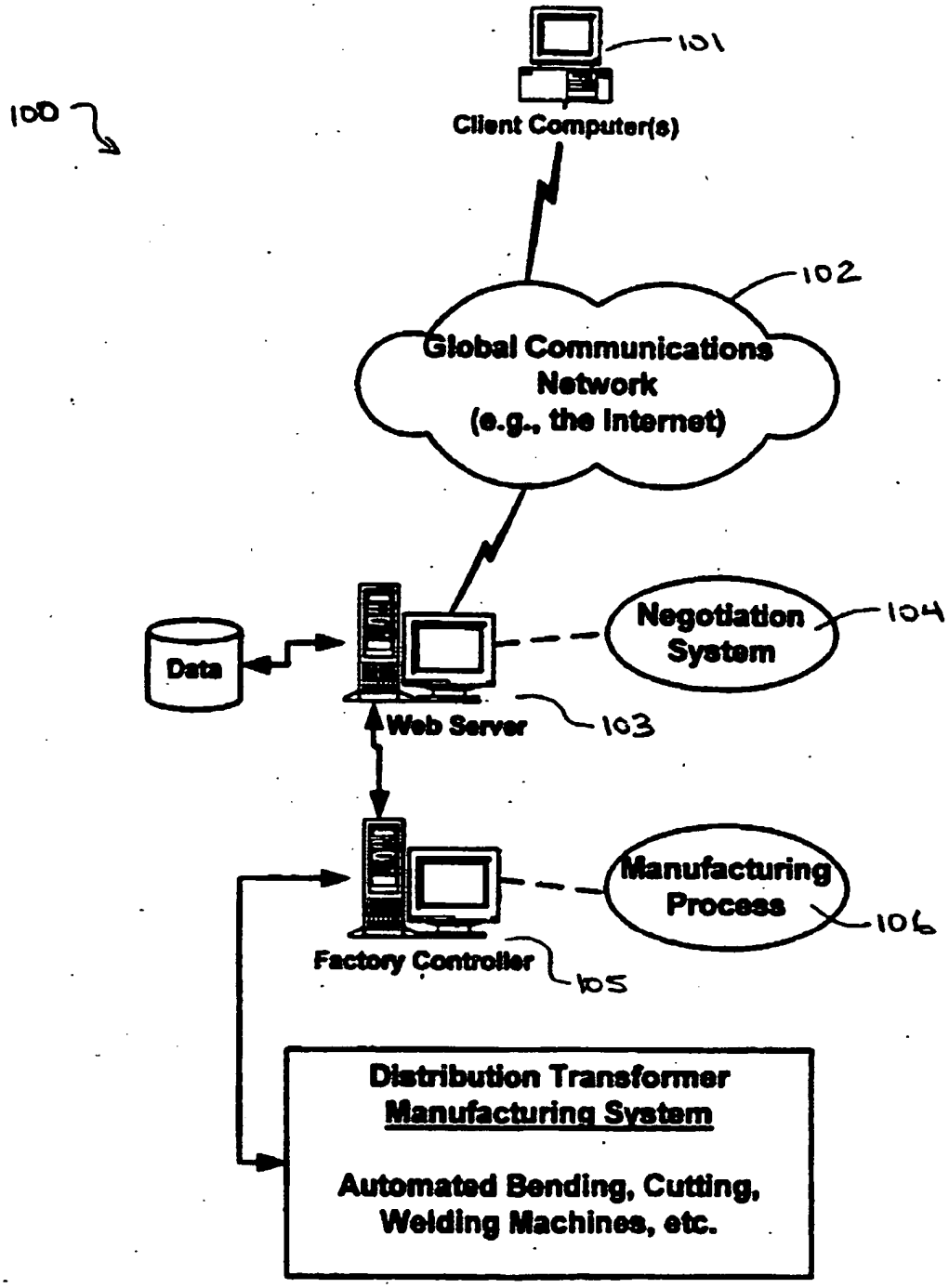

100
101
Client Computer(s)
102
Global Communications Network (e.g., the Internet)
Data
Negotiation System
104
Web Server
103
Manufacturing Process
106
Factory Controller
105
Distribution Transformer Manufacturing System
Automated Bending, Cutting, Welding Machines, etc.

Figure 1

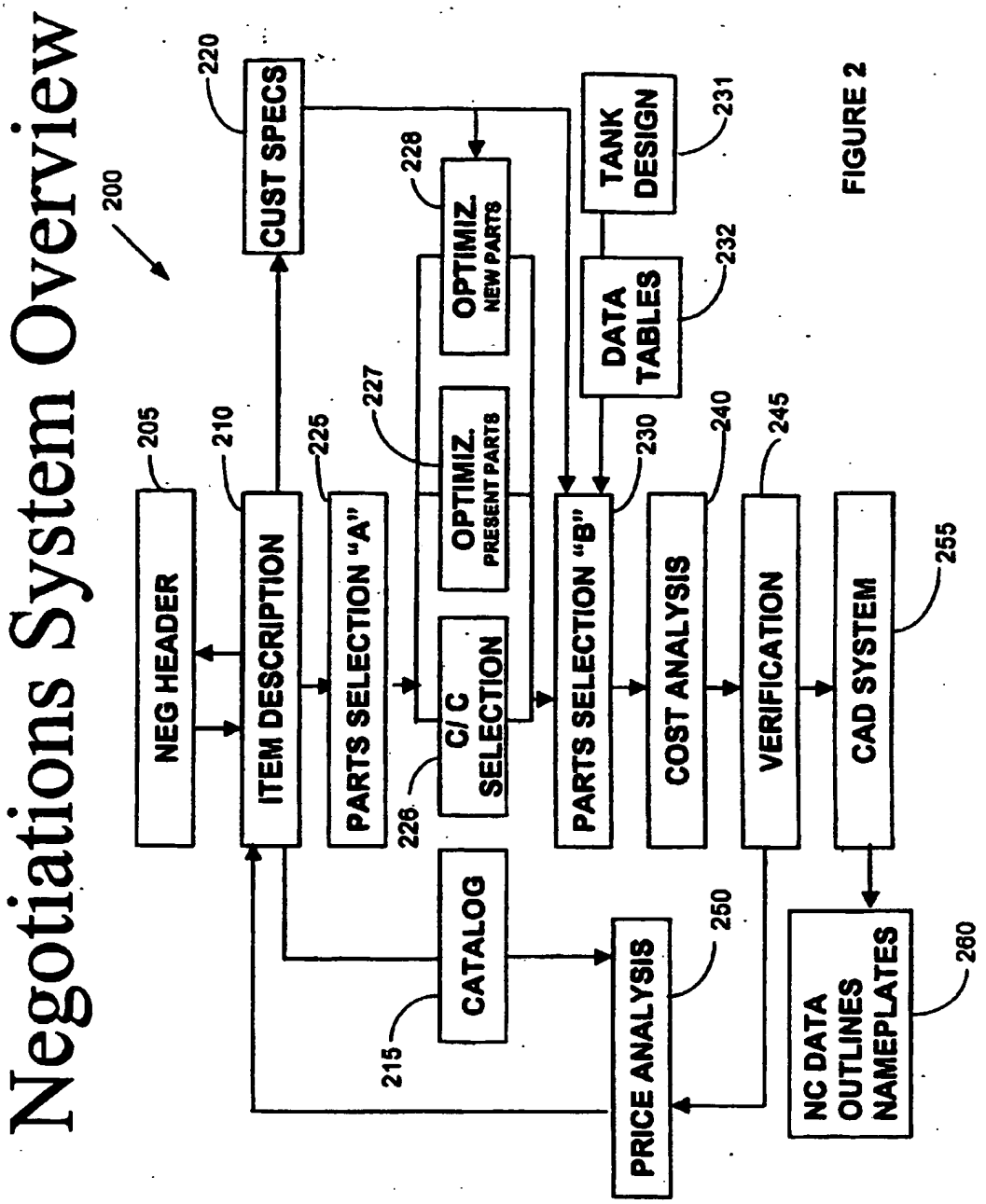
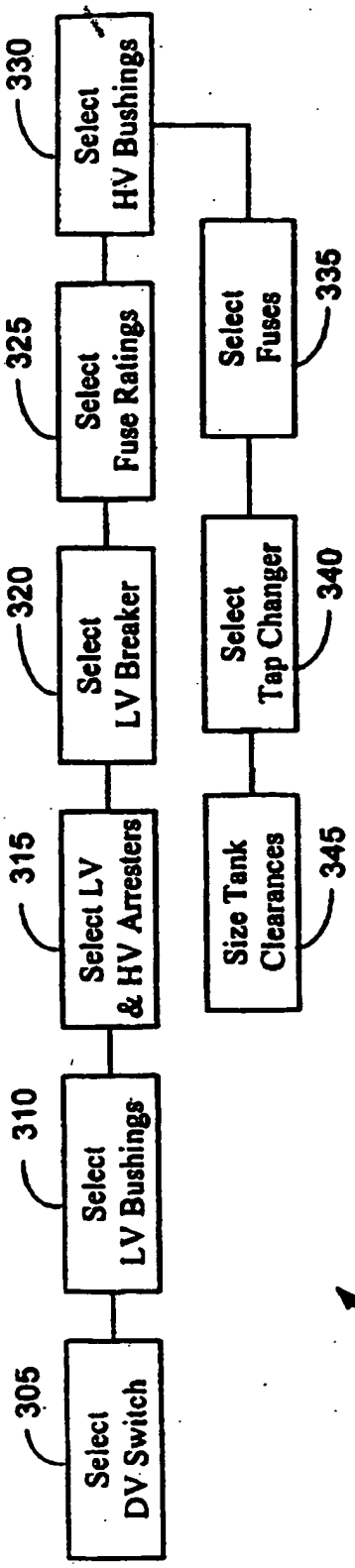

Negotiations System Overview
200
NEG HEADER
205
ITEM DESCRIPTION
210
CUST SPECS
220
PARTS SELECTION "A"
225
OPTIMIZ. PRESENT PARTS
227
OPTIMIZ. NEW PARTS
228
C/ C SELECTION
226
CATALOG
215
PARTS SELECTION "B"
230
TANK DESIGN
231
DATA TABLES
232
COST ANALYSIS
240
VERIFICATION
245
CAD SYSTEM
255
PRICE ANALYSIS
250
NC DATA OUTLINES NAMEPLATES
260

FIGURE 2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305
Select LV Bushings
310
Select LV & HV Arresters
315
Select LV Breaker
320
Select Fuse Ratings
325
Select HV Bushings
330
Size Tank Clearances
345
Select Tap Changer
340
Select Fuses
335
300

FIGURE 3A

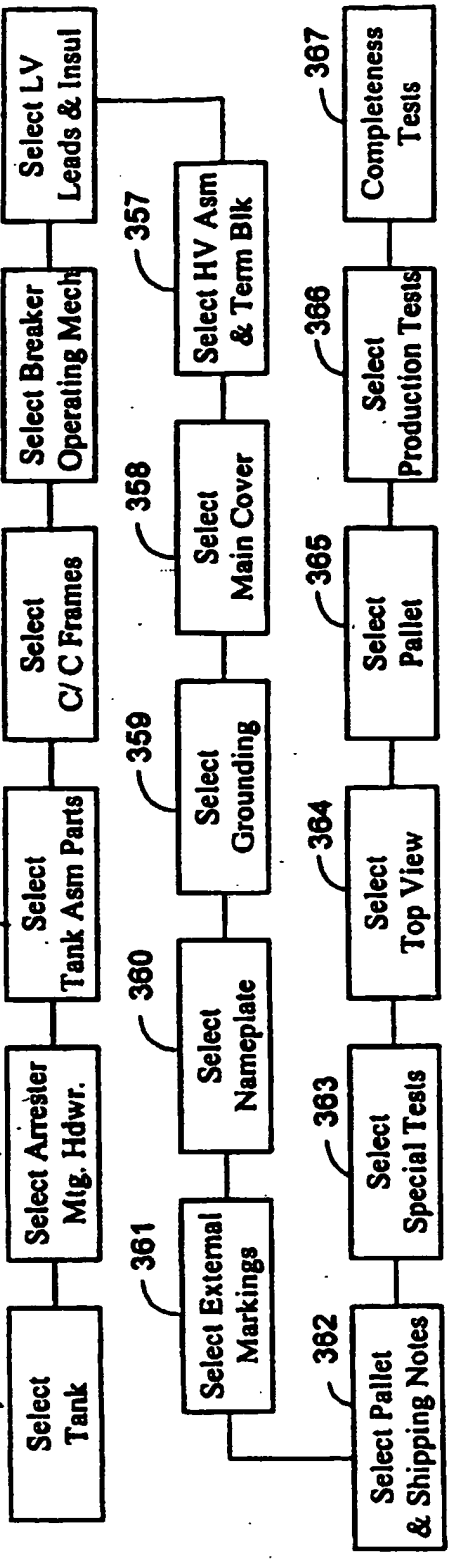

Select Tank
351
Select Arrester Mtg. Hdwr.
352
Select Tank Asm Parts
353
Select C/ C Frames
354
Select Breaker Operating Mech
355
Select LV Leads & Insul
356
Select HV Asm & Term Blk
357
Select Main Cover
358
Select Grounding
359
Select Nameplate
360
Select External Markings
361
Select Pallet & Shipping Notes
362
Select Special Tests
363
Select Top View
364
Select Pallet
365
Select Production Tests
366
Completeness Tests
367
350

FIGURE 3B

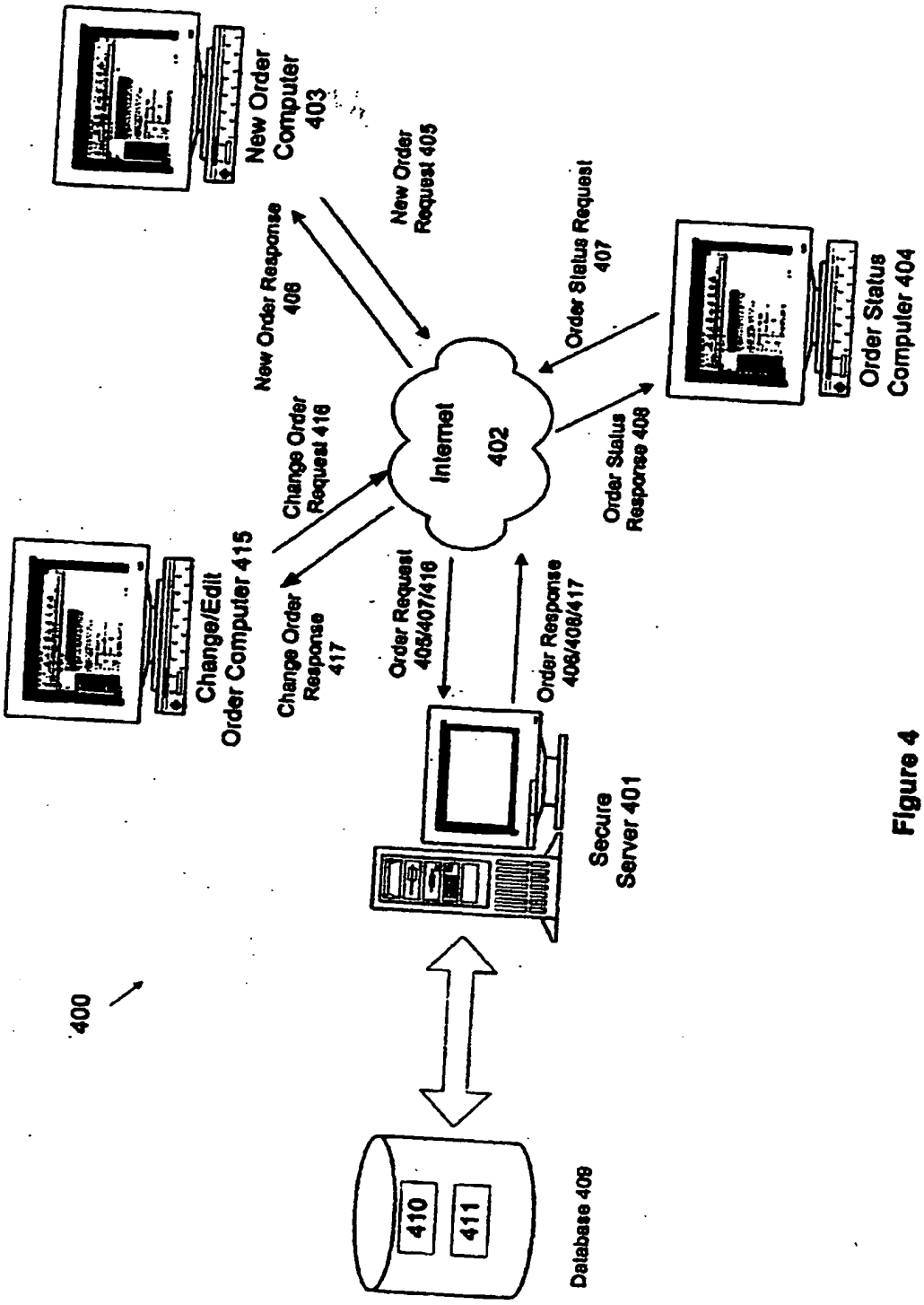

New Order Computer 403
New Order Request 405
New Order Response 406
Order Status Request 407
Order Status Computer 404
Internet 402
Change Order Request 416
Order Status Response 408
Change/Edit Order Computer 415
Change Order Response 417
Order Request 408/407/416
Order Response 408/408/417
Secure Server 401
400
410
411
Database 408

Figure 4

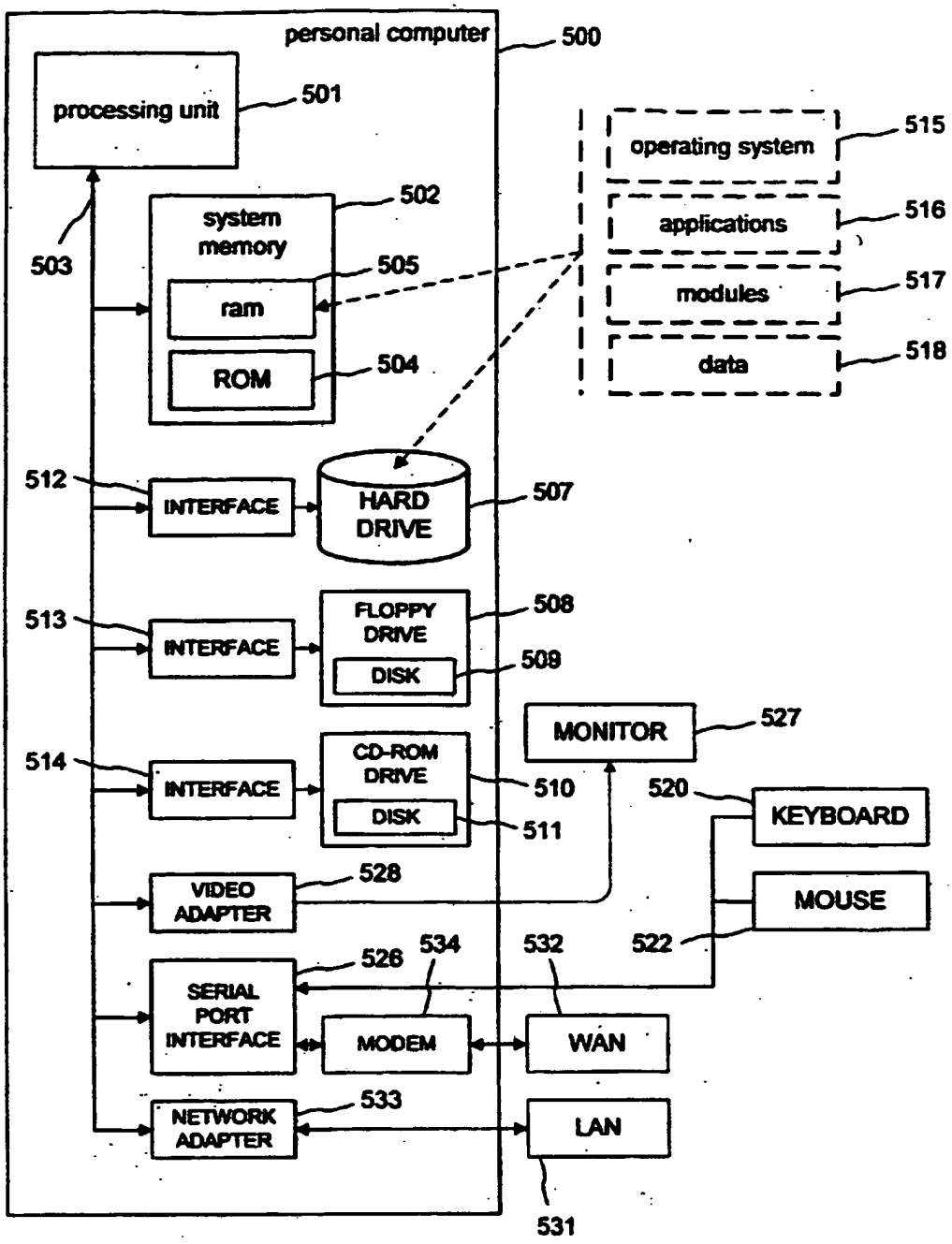

personal computer
500
processing unit
501
503
system memory
502
ram
505
ROM
504
operating system
515
applications
516
modules
517
data
518
512
INTERFACE
HARD DRIVE
507
513
INTERFACE
FLOPPY DRIVE
508
DISK
509
MONITOR
527
514
INTERFACE
CD-ROM DRIVE
510
DISK
511
520
KEYBOARD
MOUSE
522
VIDEO ADAPTER
528
SERIAL PORT INTERFACE
526
534
532
MODEM
WAN
NETWORK ADAPTER
533
LAN
531

Figure 5

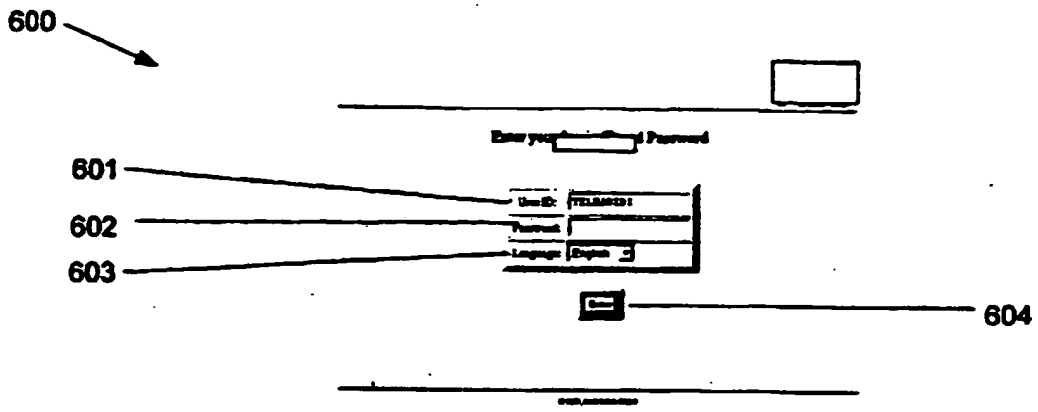


FIGURE 6

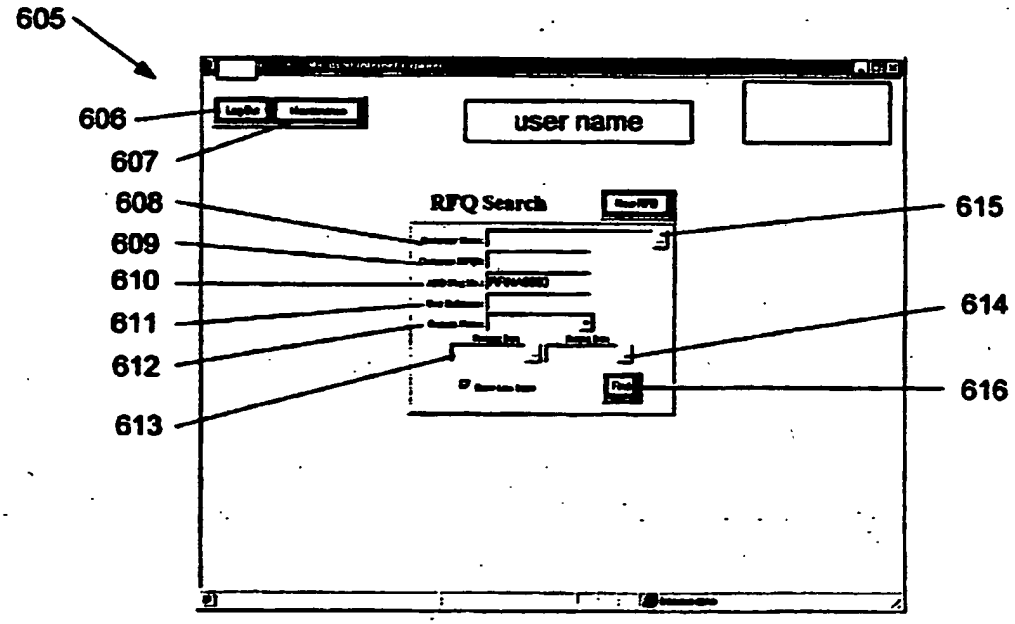


FIGURE 7

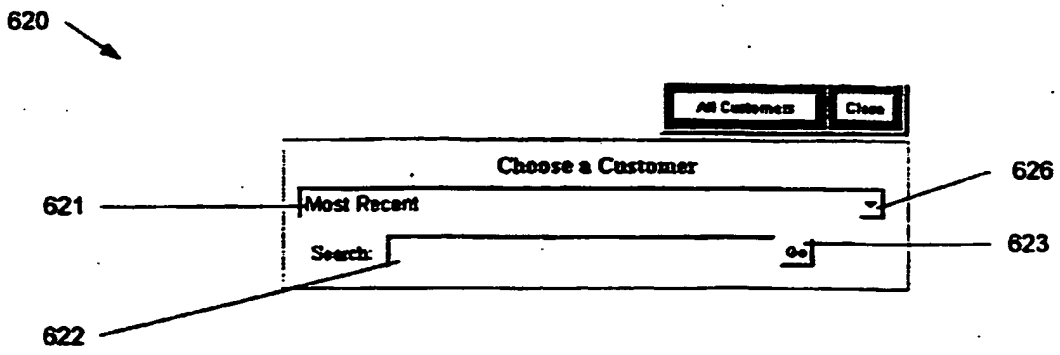


FIGURE 8A

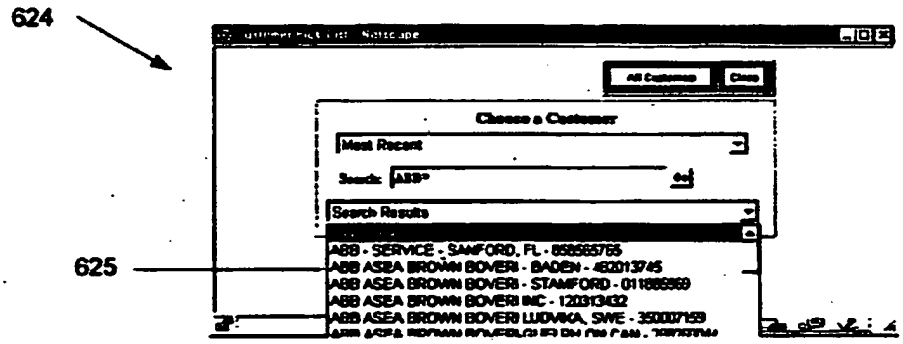


FIGURE 8B

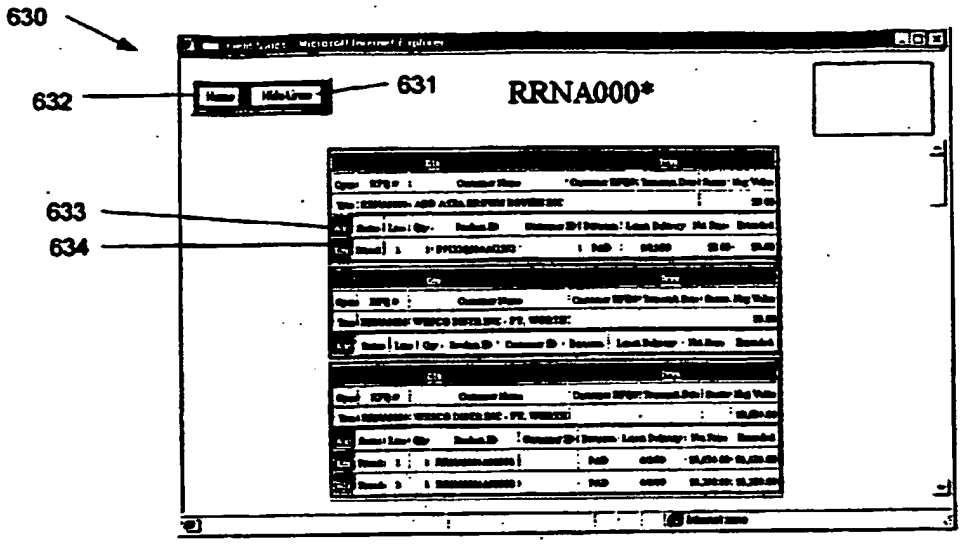


FIGURE 9

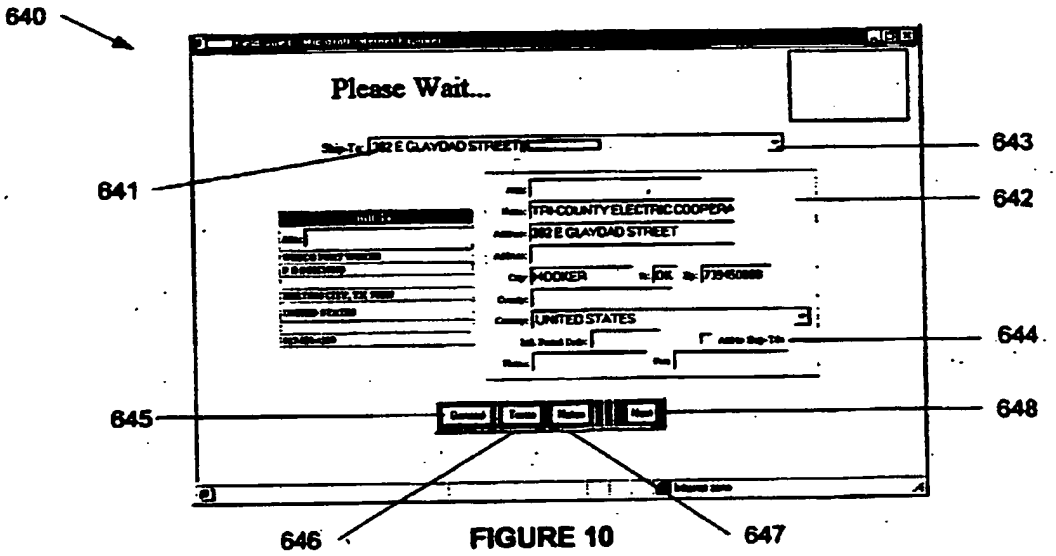


FIGURE 10

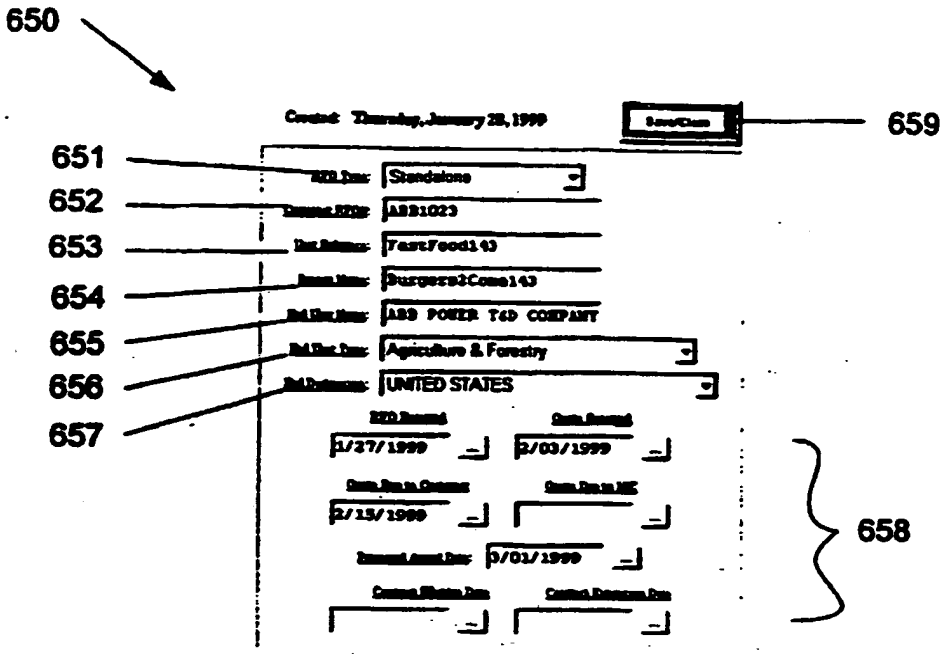
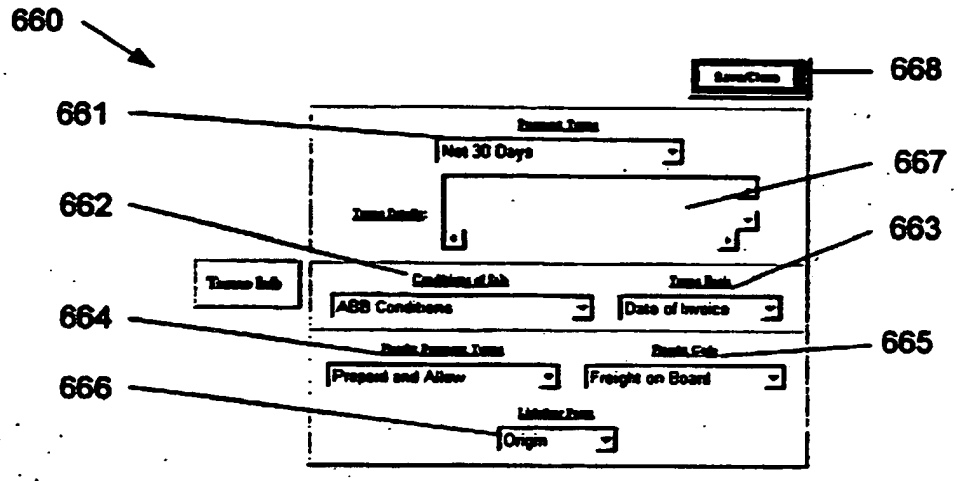


FIGURE 11



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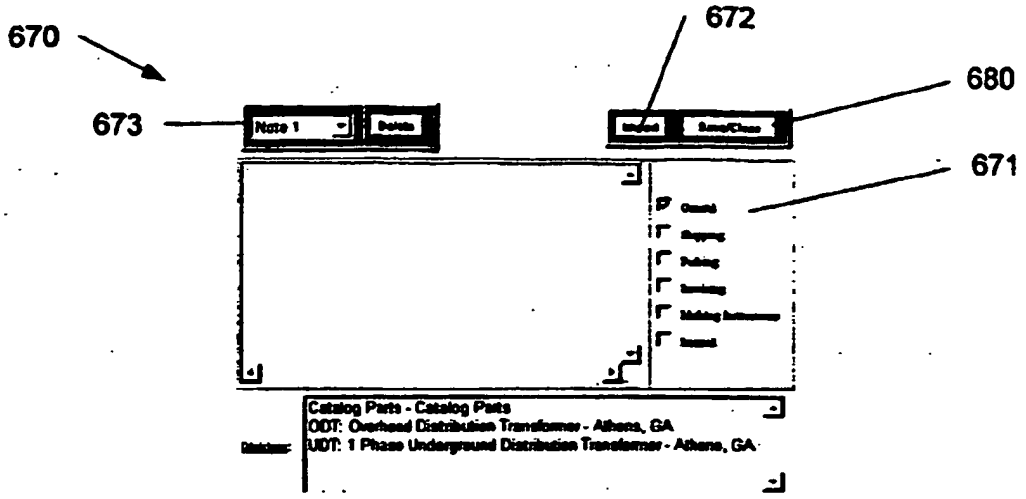


FIGURE 13A

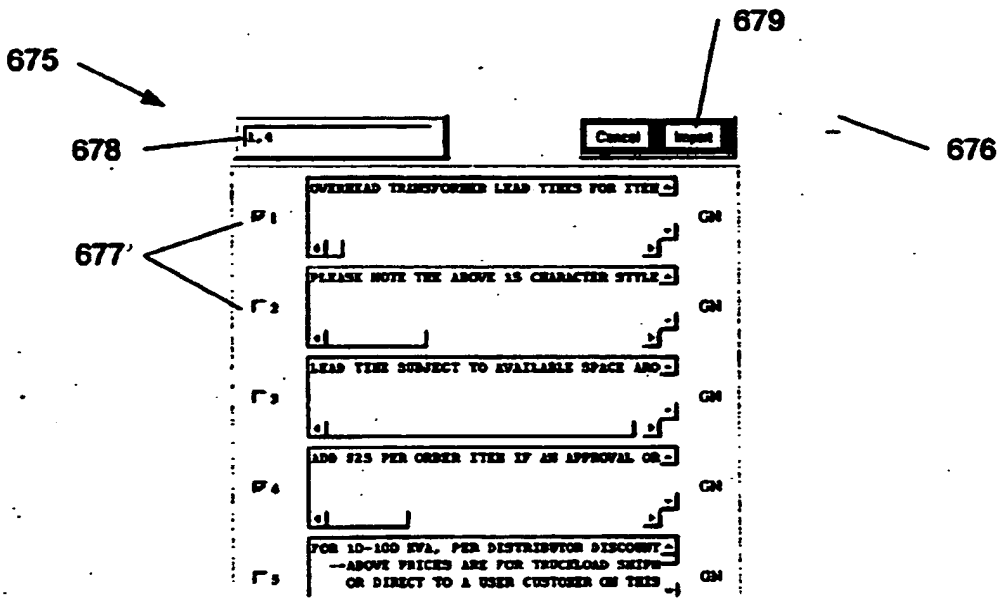


FIGURE 13B

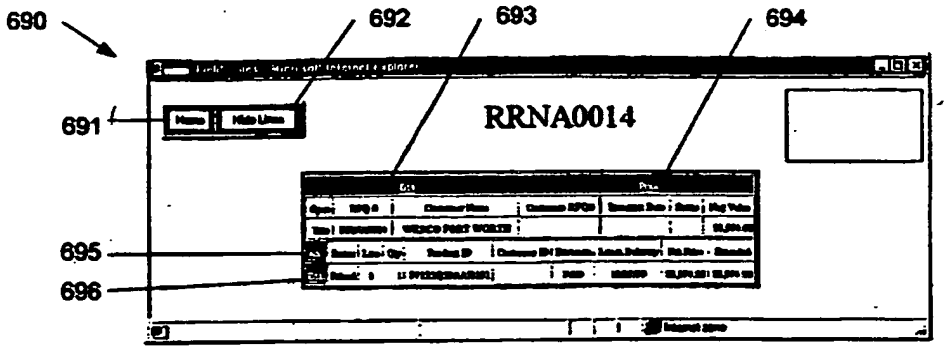


FIGURE 14A

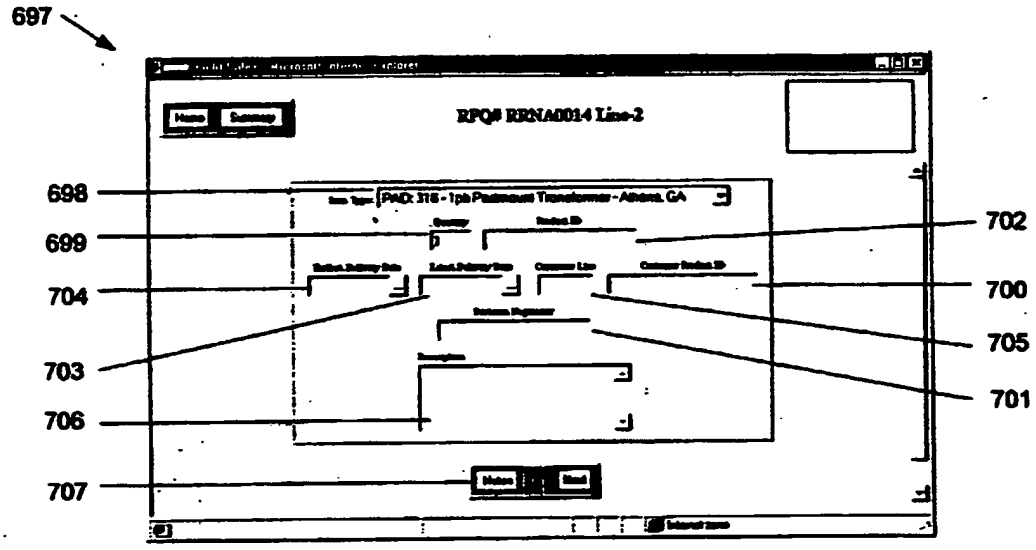


FIGURE 14B

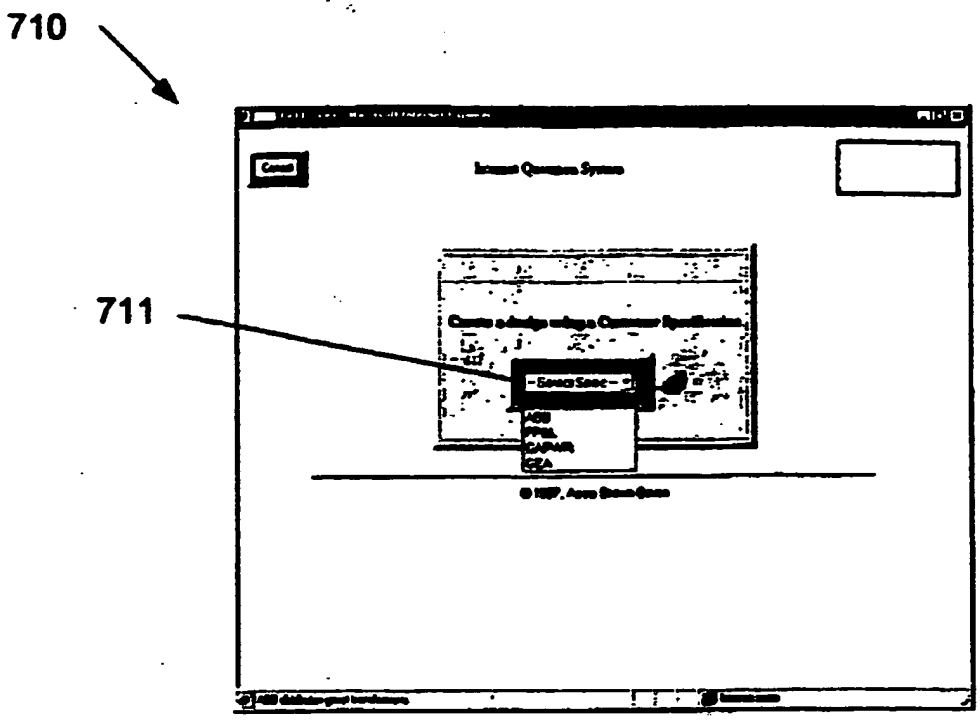


FIGURE 15A

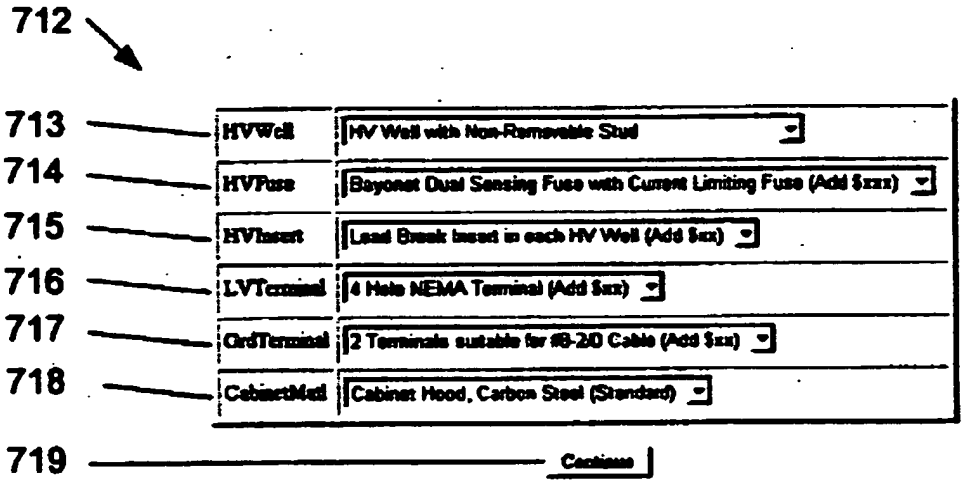


FIGURE 15B

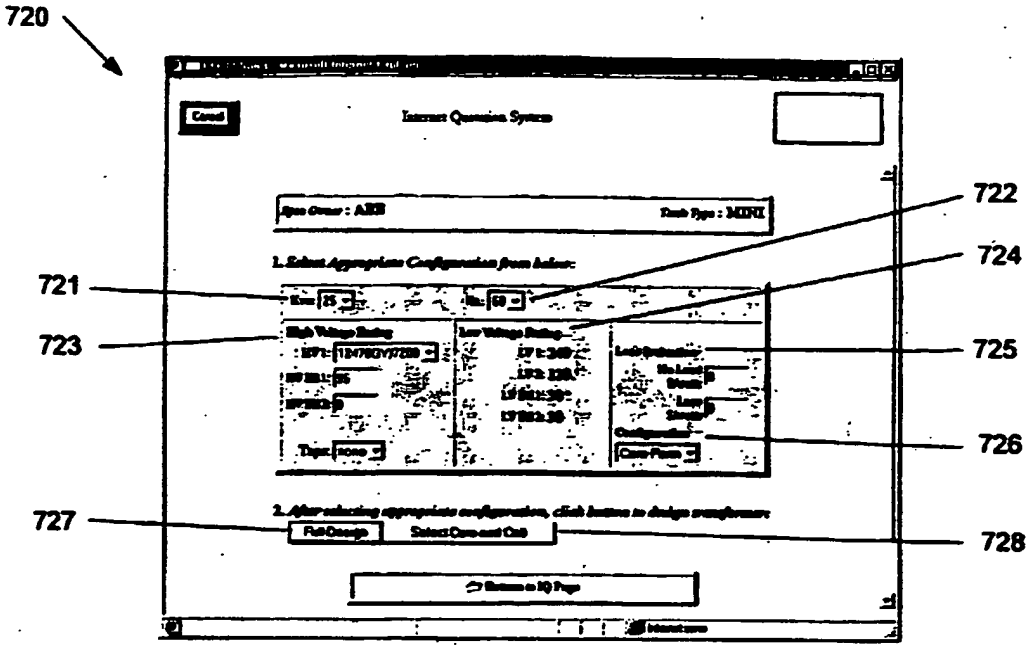


FIGURE 16

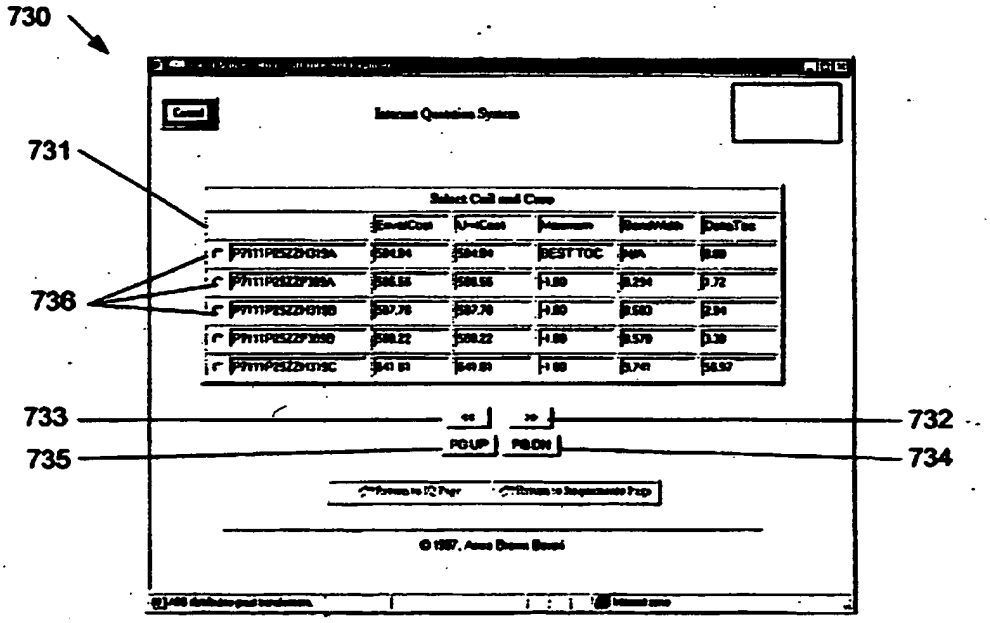
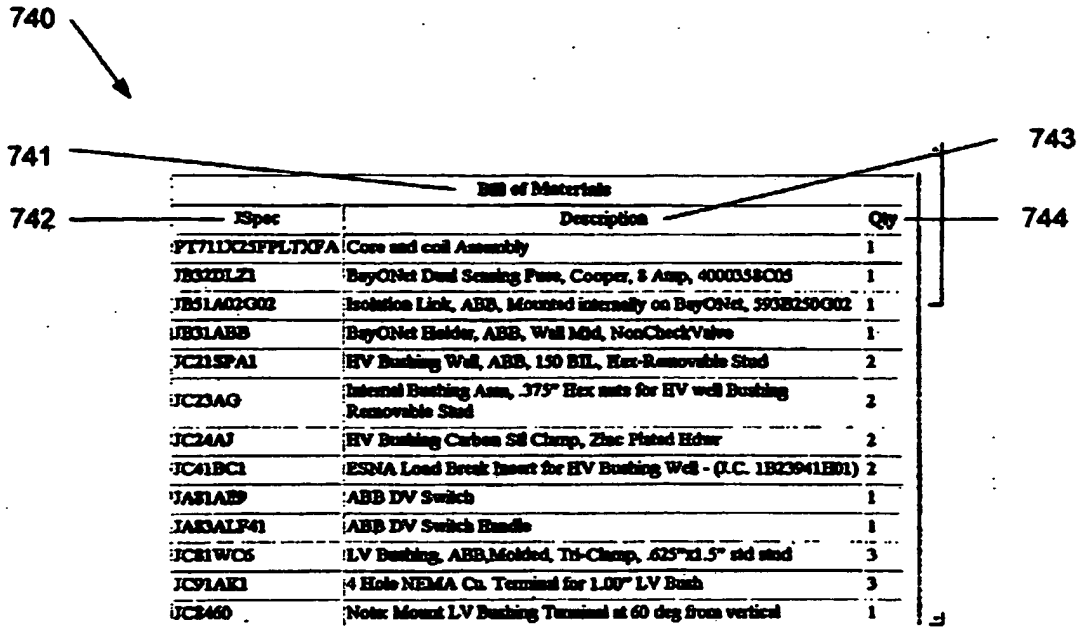


FIGURE 17



Bill of Materials

XSpec	Description	Qty
PT71JC25FPLTXPA	Core and coil Assembly	1
JB32DLZ1	BayONet Dual Sensing Fuse, Cooper, 8 Amp, 40003SBC08	1
JB51A02G02	Isolation Link, ABB, Mounted internally on BayONet, 593B250G02	1
JB31ABB	BayONet Holder, ABB, Well Mtd, NonCheckValve	1
JC21SPA1	HV Bushing Well, ABB, 150 BIL, Hex-Removable Stud	2
JC23AG	Internal Bushing Assm, .375" Hex nuts for HV well Bushing Removable Stud	2
JC24AJ	HV Bushing Carbon Sil Clamp, Zinc Plated Hdwr	2
JC41BC1	ESNA Load Break Insert for HV Bushing Well - (J.C. 1B23941B01)	2
JA81AB9	ABB DV Switch	1
JA83ALF41	ABB DV Switch Handle	1
JC81WC6	LV Bushing, ABB,Molded, Tri-Clamp, .625"x1.5" std stud	3
JC91AK1	4 Hole NEMA Cu Terminal for 1.00" LV Bush	3
JC2460	Note: Mount LV Bushing Terminal at 60 deg from vertical	1

FIGURE 18

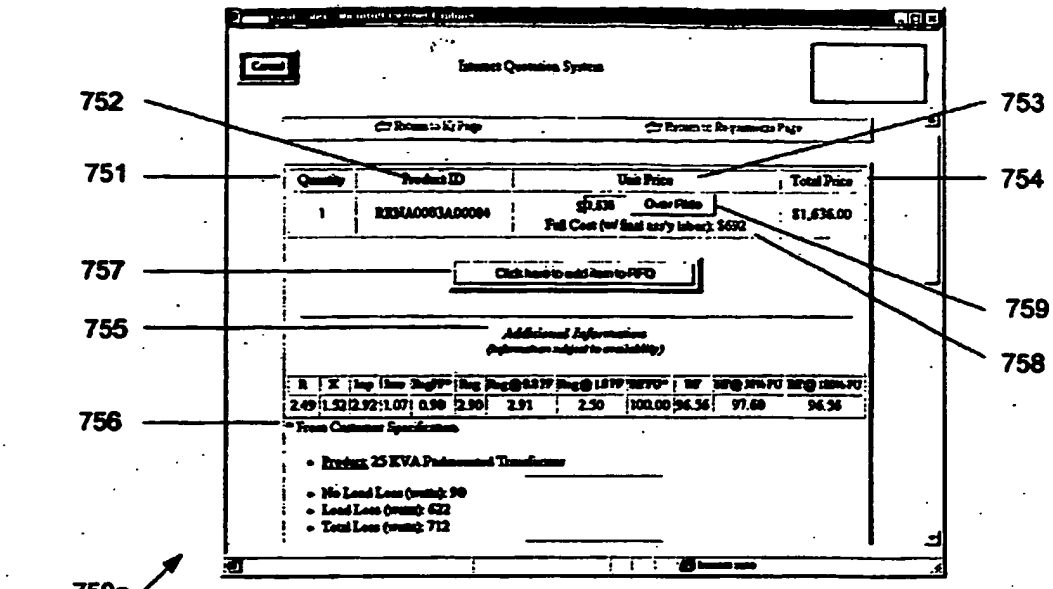


FIGURE 19A

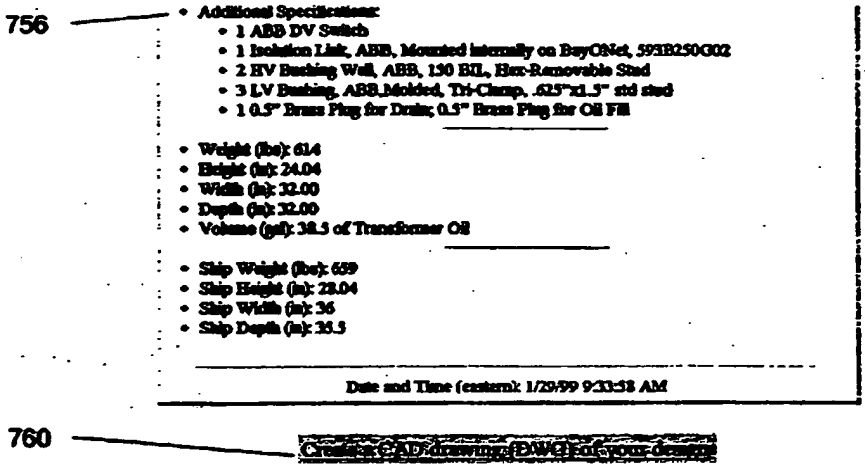


FIGURE 19B

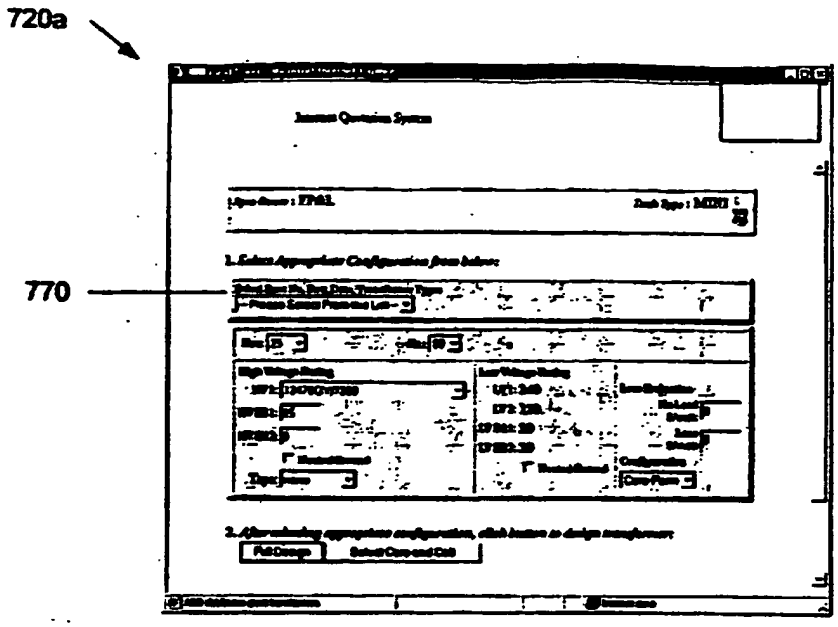


FIGURE 20

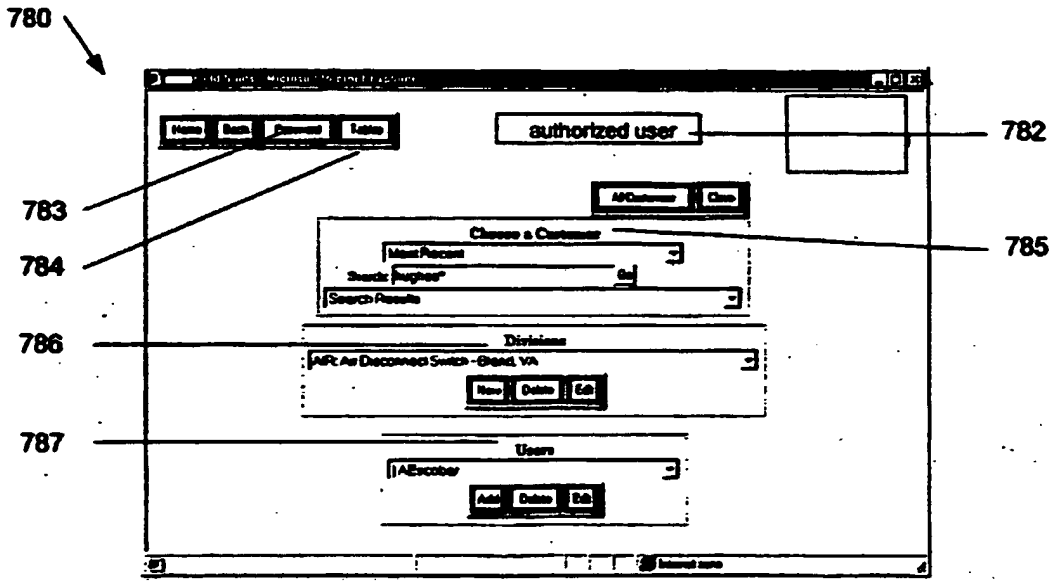


FIGURE 21

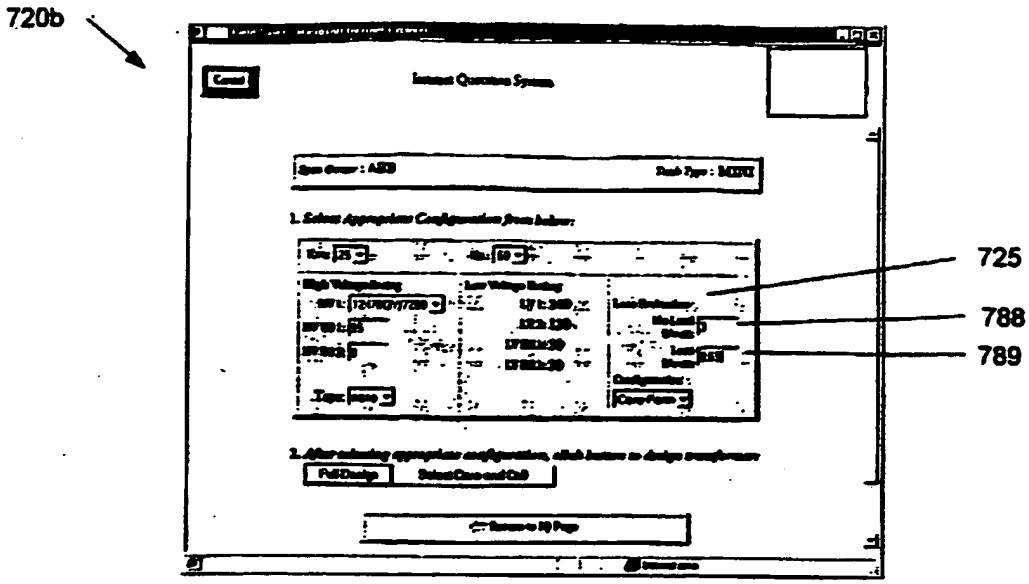


FIGURE 22

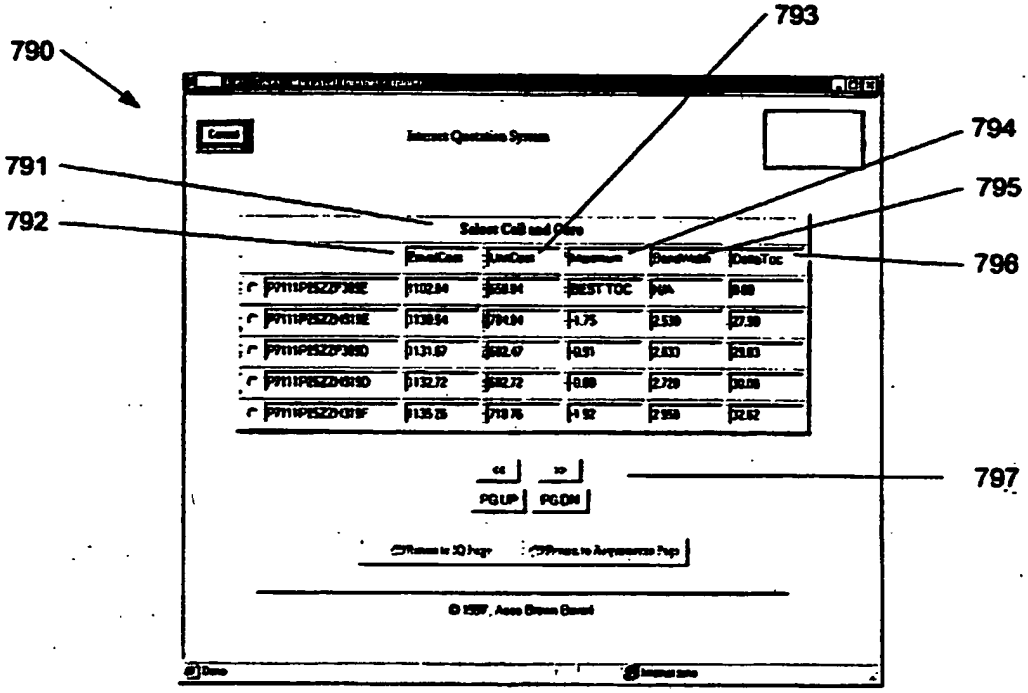


FIGURE 23

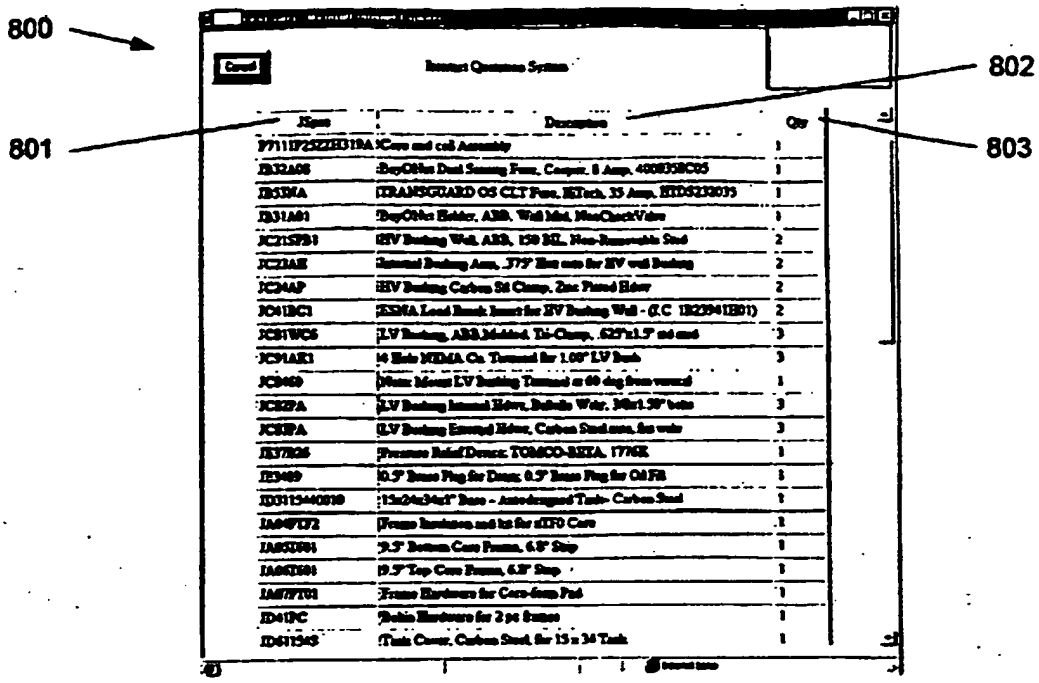


FIGURE 24

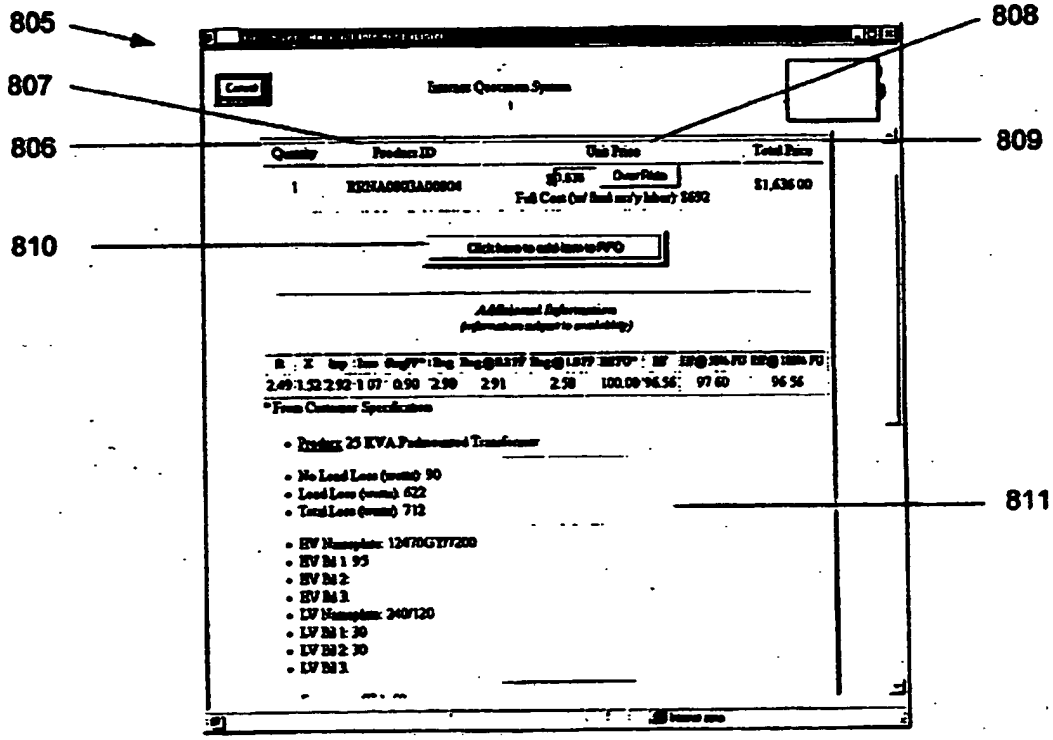


FIGURE 25

ON-LINE DESIGN OF DISTRIBUTION TRANSFORMERS

FIELD OF THE INVENTION

[0001] The present invention relates in general to integrated business systems, and particularly, to an integrated business system for the on-line ordering of distribution transformers.

BACKGROUND OF THE INVENTION

[0002] The current system for ordering electrical distribution transformers is an expensive and inefficient system. Under the current system, one or more field sales representatives meet with a customer who requires a distribution transformer to determine the customers needs. The field sales representative then relays this information to one or more internal sale representatives where the ordering information is further defined. The ordering information is then forwarded to one or more design engineers. The design engineer employs one or more draftspersons to work with the design engineer in developing the engineering design and drawings for the transformer in accordance with the customer's requirements. Numerous planning and scheduling persons develop a plan for the material acquisition and manufacture of the transformer as well as for the payment and delivery of the completed transformer. Once the design of the transformer has been completed, the design is forwarded to the manufacturing department or division where the actual construction of the transformer occurs in accordance with the engineering design and drawings. Finally, the completed transformer is shipped to the customer.

[0003] As can be appreciated, this conventional process for ordering transformers is expensive, very labor intensive, and time consuming due to the relatively large number of people involved and the numerous steps involved in the ordering process. Therefore, a need exists for a new seamless business system for the on-line ordering of transformers which is less expensive and less time consuming.

SUMMARY OF THE INVENTION

[0004] The transformer ordering system and method can be integral in designing and ordering high quality distribution transformers. The transformer ordering system and method preferably use interactive tools to assure quick and knowledgeable design and ordering of distribution transformers. As such, the transformer ordering system and method go beyond the traditional sales and marketing, design, manufacturing, etc. before a Request For Quote (RFQ) is generated. The transformer ordering system and method can be partnered with other design and ordering systems to provide full service ordering, or, alternatively, it may be a stand-alone Internet-based ordering system.

[0005] The present invention includes a system for facilitating the on-line configuration and pricing of a distribution transformer. The on-line configuration and pricing occurs between one or more users and one or more manufacturers of transformers, preferably over a network capable of providing communications between the manufacturers and a user sites associated with each user. Each user site includes an input device and a display device for use by the user in communicating information between the user site and a system server. A web site is coupled to the server and is accessible from each user site via a network.

[0006] A database is provided for storing transformer manufacturer design data for use by the user in designing a transformer to specific design requirements and also for storing transformer pricing data for use in producing a price quotation based on a transformer design designated by the user. The database is accessible by the server.

[0007] A display means is provided on the web site for causing transformer design data of at least one manufacturer to be represented on the display device. A product configuration means is also provided on said web site for use by the user in designing a transformer by selecting transformer design data displayed by the display means using the input device to configure the transformer. A product description means is provided on said web site for displaying to the user a product description resulting from product configuration means. The product description preferably includes calculated performance characteristics and a list of mechanical and electrical features. A pricing means is also provided on said web site for calculating a price of the transformer designed by the user. The calculated price and the product description are displayed to the user via the web site.

[0008] The transformer ordering system may further include a product ordering means provided on the web site for use by the user in entering an order for the transformer using, for example, the input device after reviewing the product description and the calculated price of the transformer. The transformer order is received by the server and can be forwarded to the selected manufacturer for manufacturing of the transformer in accordance with the product description.

[0009] The database can also store customer identification information indicative of a customer's identity, location, and billing policy. This allows the user to access the customer identification information in the database via the server and make a single selection via, for example, the web site which thereby incorporates all of the customer identification information into the order.

[0010] The product configuration means can further include a form-based menu for use by the user in malting selections. The design specification data represented on the display device can further include one or more of predefined product specification data and a selection of options from a predefined set of choices that are accessible via the form-based menu using the input device. The selection of one of the predefined product specification data by the user preferably results in incorporation of all of the manufacturing design specification data into the product description and the product pricing.

[0011] The transformer ordering system preferably includes an order editing means for use by a user in changing a previously entered transformer order via the web site using the input device. In addition, the transformer ordering system preferably includes an order statusing means for use by a user in accessing the system to obtain a status of a previously entered transformer order at the display device.

[0012] The product pricing means preferably includes a cost analysis of the bill of materials, a manufacturing cost, and a suggested selling price for the transformer configured by the user.

[0013] The transformer ordering system includes a manufacturing bill of materials generated by the product configuration means. The system may also employ a shopping cart means for use by the user in adding one or more ordered items to a shopping cart on the web site. The shopping cart means preferably includes an upper level used to display general information to the user, such as for example, a price, a quantity, a product identification number, and a delivery lead-time of said designed transformer. The shopping cart means also preferably includes a lower level which is not displayed to said user, and includes, for example, a bill of materials and mechanical and electrical performance data specific to the designed transformer.

[0014] In one embodiment, the transformer ordering system further includes a drawing development means on the web site for creating drawings on the server depicting the designed transformer. Preferably, the drawings can be downloaded to the remote user site and also can be communicated to a manufacturer of the designed transformer.

[0015] The present invention is also directed to a method for creating an on-line request for quote for a distribution transformer. The method includes the steps of: providing a server accessible by a user from a remote location for receiving a request for quote from the user; receiving customer data into the server, receiving ship to information for the customer into the server, providing terms relating to terms of sale for selection by the user relating to the request for quote; providing notes relating to different stages in completing the request for vote for selection by the user for attachment to the request for quote; providing a shopping cart to which the user may add one or more items selected for the request for quote; providing a designing server accessible by the user from a remote location for designing a transformer in accordance with the request for quote; providing one or more manufacturer design specifications for use by the user in designing the transformer, generating a bill of materials and a transformer description in accordance with the request for quote for the designed transformer, calculating a manufacturing cost for the transformer based on the bill of materials; and displaying user request for quote at the remote location.

[0016] The method can further include the step of receiving an order from the user for the transformer into the server. The method can further include the step of forwarding the order for the transformer from the server to a manufacturer of transformers for manufacturing of the transformer in accordance with the bill of materials and the transformer description.

[0017] In accordance with one aspect of the method of the present invention, the request for quote received from the user may include one of a new request for quote and an existing request for quote previously entered into the server.

[0018] The method can further include the step of creating drawings on the server based of the bill of materials and a transformer description, the drawings being adapted for download to the user's remote location and for attachment to the request for quote.

[0019] In accordance with another aspect of the present invention, the step of providing a designing server accessible by a user from a remote location for designing a transformer further comprises designing and defining items according to predetermined manufacturing specifications including adding accessories and selecting a core and coil.

[0020] The step of providing a designing server may further include the steps of providing a first parts selection menu for use by the user in selecting internal accessory parts independent of the core and coil, providing a menu for selecting a coil and coil, and providing a second parts selection menu for use by the user in selecting external parts for packaging the core and coil.

[0021] The method can further include the step of storing customer data and transformer manufacturer design data in a database that is accessibly from the server for use by the user in completing the on-line request for quote for a transformer. Preferably, the method also includes the step of allowing a user to check the status of a previously submitted request for quote from a remote location.

[0022] Other features of the invention are described below.

BRIEF DESCRIPTION OF THE DRAWINGS

[0023] The foregoing summary, as well as the following detailed description of the preferred embodiments, is better understood when read in conjunction with the appended drawings. For the purpose of illustrating the invention, there is shown in the drawings embodiments that are presently preferred, it being understood, however, that the invention is not limited to the specific methods and instrumentalities disclosed. In the drawings:

[0024] **FIG. 1** is a schematic diagram of an exemplary on-line design and ordering system for distribution transformers;

[0025] **FIG. 2** is a flowchart illustrating an exemplary negotiation and design process for the on-line design and ordering system for distribution transformers;

[0026] **FIGS. 3A and 3B** are flowcharts showing further details of the negotiation and design process of **FIG. 2**;

[0027] **FIG. 4** shows an exemplary client-server system for ordering, designing, editing, and statusing a transformer order in according with the present invention;

[0028] **FIG. 5** is a shows an exemplary computing environment for the on-line design of distribution transformer system in accordance with the present invention;

[0029] **FIG. 6** is a screen shot of an exemplary login ID and password screen;

[0030] **FIG. 7** is a screen shot of an exemplary RFQ search screen;

[0031] **FIG. 8A** is a screen shot of an exemplary choose a customer screen;

[0032] **FIG. 8B** is a screen shot of an exemplary customer search from search results screen;

[0033] **FIG. 9** is a screen shot of an exemplary RFQ results screen;

[0034] **FIG. 10** is a screen shot of an exemplary ship to screen;

[0035] **FIG. 11** is a screen shot of an exemplary general customer information screen;

[0036] **FIG. 12** is a screen shot of an exemplary customer terms screen;

[0037] **FIG. 13A** is a screen shot of an exemplary notes summary screen;

[0038] **FIG. 13B** is a screen shot of an exemplary general imported noted screen;

[0039] **FIG. 14A** is a screen shot of an exemplary shopping cart screen;

[0040] **FIG. 14B** is a screen shot of an exemplary line item screen;

[0041] **FIG. 15A** is a screen shot of an exemplary design specification screen;

[0042] **FIG. 15B** is a screen shot of an exemplary design accessories screen;

[0043] **FIG. 16** is a screen shot of an exemplary ratings screen;

[0044] **FIG. 17** is a screen shot of an exemplary select core and coil screen;

[0045] **FIG. 18** is a screen shot of an exemplary bill of materials screen;

[0046] **FIG. 19A** is a screen shot of an exemplary top of published design screen;

[0047] **FIG. 19B** is a screen shot of an exemplary bottom of published design screen;

[0048] **FIG. 20** is a screen shot of an exemplary other manufacturing specification ratings screen;

[0049] **FIG. 21** is a screen shot of an exemplary maintenance screen;

[0050] **FIG. 22** is a screen shot of an exemplary loss evaluation screen;

[0051] **FIG. 23** is a screen shot of an exemplary core/coil selection screen;

[0052] **FIG. 24** is a screen shot of an exemplary bill of material screen wherein the cost data is a hidden column; and

[0053] **FIG. 25** is a screen shot of an exemplary pricing screen.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0054] The present invention relates to a "lights out" factory for the production of transformers, such as small, simple pad mounted distribution transformers. An external user, i.e., a customer or a field sales person, is permitted to orchestrate the entire production process to meet his or her requirements. The user is able to configure the product and produce a quotation. The user is also able to submit orders, review scheduling, and receive confirmation of the manufacture of the products in a manner similar to ordering a custom made personal computer over the Internet. In the background, the manufacturing process is automated to minimize the cycle time and the number of people required to satisfy the user's requirements. The inventive system is depicted schematically in the attached **FIG. 1**.

[0055] The negotiation system (e.g., the transformer ordering system) **100** combines the efforts of the internal sales person, the design engineer and the drafting people with the capabilities of the Internet **102**. The system presents the user at a remote location **101** with the ability to fully configure a transformer through a server **103** using a combination of a predefined product specification and a selection of options from a set of choices (i.e., a form-based menu) contained in a negotiations system **104**. This product configuration process generates the entire manufacturing bill of materials. The costs associated with each item in the bill of materials is summed to a manufacturing cost, which is then used to verify the calculation of a suggested selling price. A product description is also created. The product description includes the calculated performance characteristics and a summarized list of mechanical and electrical features.

[0056] The customer is presented electronically with a finished quotation document, including an outline drawing suitable for installation purposes. From this quotation document, the customer is capable of producing an order that is transmitted into the manufacturing system, such as factory controller **105**, to initiate the production of transformers in the manufacturing process **106**.

[0057] The system has the usual capability of a "shopping cart" The user can add as many different items to the shopping cart as desired. Each new item is identified as a particular type of product, such as a distribution transformer. Other products may be added as well. At the shopping cart level, the system only keeps generic data such as price, quantity, product style number, and delivery lead-time. The actual bill of materials, and electrical and mechanical performance data, are stored at a lower level of product data, specific to the transformer manufacturer.

[0058] In addition, the customer may view the status of his or her order via the Internet.

[0059] I. Overview

[0060] The transformer ordering system **100** and method can be integral in designing and ordering high quality distribution transformers. The transformer ordering system **100** and method preferably use interactive tools to assure quick and knowledgeable design and ordering of distribution transformers. As such, the transformer ordering system **100** and method go beyond the traditional sales and marketing, design, manufacturing, etc. before a Request For Quote (RFQ) is generated. The transformer ordering system **100** and method can be partnered with other design and ordering systems to provide full service ordering, or, alternatively, it may be a stand-alone Internet-based ordering system. Those skilled in the art will readily appreciate that the description given herein with respect to those Figures is for explanatory purposes only and is not intended in any way to limit the scope of the invention.

[0061] The Web-based transformer ordering system of the present invention provides the information and design specifications to a central or integrated marketing-engineering server which acts as a central repository for the management of order and design information. The central marketing-engineering server may be a common portal that correlates the order and design data from the various vendors and customers, and thus facilitates negotiating, ordering, designing, marketing, statusing, and manufacturing quality distri-

bution transformers that meet individual customer needs and specific design requirements. In particular, central marketing-engineering server may be accessed by users (e.g., customers) of the transformer ordering system **100** to improve and streamline various aspects of ordering and designing distribution transformers. In so doing, transformer ordering system **100** may assist the transformer industry in the transformation from its current focus on sales, planning, scheduling, and marketing to focus on a seamless business system resulting in a lower cost and more efficient design and distribution basis.

[0062] For purposes of clarity, the term "user," as used herein, is intended to refer to customers of the commercial embodiment of the invention as well as salespeople, engineers, designers draftspersons, marketers, and the like. For example, where the invention is embodied in an Internet Web page format, a customer would include a visitor browsing the Web page.

[0063] Customers for transformer ordering system **100** can include, for example, electrical companies who seek improved ways to assure lower cost and improved efficiencies in ordering transformers. Power utility companies that desire to order transformers through this more cost effective and timely approach should have a presumed ordering and design advantage over competing systems. It is also anticipated that vendors themselves will become a second source of customers for the transformer ordering system **100**. Once a vendor gains access to the transformer ordering system **100**, he or she will have begun to differentiate themselves from their peers and competitors on the basis of their affiliation with the transformer ordering system **100**.

[0064] By focusing upon on-line ordering and designing of quality transformers through a comprehensive, one-stop shopping source, the transformer ordering system **100** can provide substantial improvements in cost, efficiency, and cycle time for various customers. For example, electrical companies may benefit through lower cost and improved efficiencies in ordering transformers. Power utility companies may benefit by having the tools necessary to order transformers more cost effectively and in a more timely manner thus resulting in an ordering and design advantage over competing systems.

[0065] **FIG. 2** is a flowchart illustrating an exemplary negotiation process **200** for building and pricing a desired transformer. As shown in **FIG. 2**, the negotiation process includes the steps of accessing a negotiation header, at step **205**. An item description is entered at step **210**. The item description step **210** can include several alternative processes for completing the negotiation process. For example, a user may access a catalog of different transformer designs, at step **215**, in order to specify a desired transformer from the catalog. Alternatively, the user may access a specific custom specification for different distribution transformers, at step **220**, in order to tailor the transformer to that user's specific needs. The user may then proceed to construct a bill of materials (BOM) through specific processes of Parts Selection "A", step **225**, selecting or creating a Core and Coil design, step **226**, **227**, or **228** and Parts Selection "B" (discussed in more detail below).

[0066] The user may also proceed from the item description (step **210**) to a first parts selection, or part selection "A" step, at step **225**, where the user may select an internal engineering design of the transformer. At step **226**, the user may select the design for the core and coil of the transformer. At step **227**, the user may optimize the engineering design with standard/present parts. At step **228**, the user may optimize the engineering design with new parts.

[0067] After completing the parts selection "A" (step **225**), the user proceeds to a second parts selection, or parts selection "B" step, at step **230**, where the tank and other parts necessary to package the core and coil are selected. At step **231**, the tank design is selected using data tables at step **232**. This information is inputted into the negotiation process at parts selection "B". Optionally, the negotiation process **200** can include an automatic tank design.

[0068] A cost and labor analysis is performed at step **240**. The cost analysis is verified at step **245** and then a price analysis is performed at step **250**. This price analysis information is feedback to the item description (step **210**). Also, if the user had chosen to access a manufacturer's catalog, at step **215**, then they would proceed from step **215** directly to the price analysis, at step **250**.

[0069] Also, the user may select a drawing option, such a CAD system, to develop engineering design drawing for the transformer, at step **255**. This option may also be used to prepare NC data and outlines for templates to be mounted on the transformer, at step **260**.

[0070] **FIG. 3A** is a flowchart showing further details of the first parts selection step (step **225**) described above. The first part selection process **300** includes the steps for the selection of parts independent of the core and coil. The selection made during the first parts selection set minimum tank dimensions based on necessary accessories prior to the core and coil selection As shown in **FIG. 3A**, at step **305**, the user selects a DV switch. At step **310**, the user selects the LV bushings. At step **315**, the user selects the LV and HV arresters. At step **320**, the user selects the LV breaker. At step **325**, the user selects the fuse ratings. At step **330**, the user selects the HV bushings. At step **335**, the user selects the fuses. At step **340**, the user selects the tap changer. At step **345**, the user selects the size of the tank clearances. Steps **305**, **315**, **320**, **325**, **335**, and **340** are optional, and may be included to satisfy the customer specifications for the transformer. Steps **310**, **330**, and **345** preferably occur for each design.

[0071] **FIG. 3B** is a flowchart showing further details of the second parts selection step (step **230**) described above. The second part selection process **350** includes the steps for the selection of parts after the core and coil and tank, thus completing the engineering design. As shown in **FIG. 3B**, at step **351**, the user selects the tank. At step **352**, the user selects the arrester mounting hardware. At step **353**, the user selects the tank assembly parts. At step **354**, the user selects the core and coil frames. At step **355**, the user selects the breaker operating mechanism. At step **356**, the user selects the LV leads and insulation. At step **357**, the user selects the HV assembly and terminal blocks. At step **358**, the user selects the main cover. At step **359**, the user selects the grounding features and terminals. At step **360**, the user selects the nameplate. At step **361**, the user selects the external markings. At step **362**, the user selects the pallet and shipping notes. At step **363**, the user selects the special tests (if necessary). At step **364**, the user selects the factory assembly drawings. At step **365**, the user selects the pallet.

optimize

Cost & labor

OUTPUT CAD DRAWINGS

custom spec

Pallet Shipping tests

assembly drawings

At step **366**, the user selects the production tests. At step **367**, the user selects the completeness tests. Steps **352**, **355**, **357**, and **363** are preferably optionally included in the design process.

[0072] Exemplary Operating Environment

[0073] **FIGS. 1**, **4**, and **5**, and the following discussion of those Figures is intended to provide a brief, general description of an exemplary client/server system **400** from which the transformer ordering system **100** may be accessed and also a suitable computing environment **500** in which the invention may be implemented. While the invention will be described in the general context of computer-executable instructions of a computer program that runs on a personal computer, those skilled in the art will recognize that the invention also may be implemented in combination with other program modules. Generally, program modules include routines, programs, components, data structures, etc. that perform particular tasks or implement particular abstract data types. Moreover, those skilled in the art will appreciate that the invention may be practiced with other computer system configurations, including hand-held devices, multiprocessor systems, microprocessor-based or programmable consumer electronics, minicomputers, mainframe computers, and the like. The illustrated embodiment of the invention also is practiced in distributed computing environments where tasks are performed by remote processing devices that are linked through a communications network. However, it is contemplated that the invention can be practiced on standalone computers. In a distributed computing environment, program modules may be located in both local and remote memory storage devices.

[0074] Client-Server System Interface

[0075] **FIG. 4** is a block diagram of an exemplary client/server system **400** in which the transformer ordering system **100** may be implemented. **FIG. 4** illustrates an exemplary client/server system **400** for receiving new orders from one or more users (e.g., customers) into the transformer ordering system **100**, for editing existing orders, and also for receiving status queries from a user for previously submitted orders.

[0076] As shown in **FIG. 4**, the details of a new transformer order and/or order status inquiry may be entered using a network appliance or data entry device. The network appliance may include, for example, computers **403**, **404**, and **415** of a customer of the transformer ordering system **100**, or the like. The structure of computers **403**, **404**, and **415** is described below with reference to **FIG. 5**. The transformer ordering system **100** may have a plurality of computers, similar to computers **403**, **404**, and **415**, each coupled to the transformer ordering system **100** through an appropriate interface connection. Each computer **403**, **404**, **415** may be a dedicated terminal or a multi-purpose terminal with access to network **402**, such as an Internet, an Intranet, an Extranet, etc. For example, each computer **403**, **404**, **415** may be a computer with Internet access located in a customer's office, a customer's home, or a customer's facilities and may be used routinely to access the Internet and to keep and communicate ordering and design data and information between the customer and the transformer ordering system **100**. In this instance, new order data **410** and/or order status data **411** may be received and stored by the transformer ordering system **100** after it is received from, for example, a customer who has been granted access to the transformer ordering system **100** (e.g., either for an initial or new order or for ascertaining the status of an existing or previously submitted order).

[0077] Alternatively, computers **403**, **404**, **415** may be a network appliance located at any third party location for access by any individual user, including a customer of the transformer ordering system **100**. In this way, a user may request new ordering data **410** and/or obtain the status of an existing order **411** in any environment. Computers **403**, **404**, **415** may be personal computing devices (as shown in **FIG. 5**) that have Internet hypertext mark up language (html)-based browser software installed thereon, such as, for example, INTERNET EXPLORER available from MICROSOFT Corporation. It should also be understood that while three computers **403**, **404**, and **415** are shown in **FIG. 4**, in practice there may be a plurality of network appliances for submitting new ordering data **410**, editing an existing order, and for querying the transformer ordering system **100** to request the status of an existing order data **411**.

[0078] Although **FIG. 4** shows computers **403**, **404**, and **415** as personal desktop computing devices, it should be appreciated that computers **403**, **404**, and **415** may be any type of network appliance. For example, each computer **403**, **404**, **415** may be a wireless personal hand-held device of the type available from PALM Incorporated. Computers **403**, **404**, and **415** also may be cellular telephone devices or portable laptop computers, both available from a wide array of manufacturers. In fact, computers **403**, **404**, and **415** may be any kind of processing device able to communicate with a particular network **402**, like the Internet.

[0079] Preferably, the transformer ordering system **100** includes business to business, as well as business to consumer, enabling technology having an open standards framework and provides gateways to various methods of interprocess communications. The transformer ordering system **100** can be accessed and activated by a person, such as a customer of the system. Alternatively, the transformer ordering system **100** may be accessed by another system. The enabling technology of the present invention preferably includes a server and the framework to allow the system to bring open standards business to business integration. An open standard system is preferred because it allows the system to be readably integrated with most conventional ordering systems, design systems, marketing systems, manufacturing systems, financial systems, communications (e.g., email) systems, and the like. Any suitable enabling technologies can be used with the present invention to allow the transformer ordering system **100** to bring open standards business to business integration. In one embodiment, SYMIX may be used as the business system to provide e-business software and services.

[0080] Preferably the enabling technology has two main components, a business to business e-commerce framework built on open standards, and a product that implements the framework on an operating system, such as Windows or the like, and facilitates application integration.

[0081] Preferably, the transformer ordering system framework allows business to business e-commerce to be implemented by passing messages among parties (e.g., manufacturers, customers, vendors, designers, shippers, etc.) in a loosely coupled network, such as an Intranet and the Internet

This is a time-tested architecture for scalable and reliable transaction processing. All such efforts preferably define message formats that describe the business to be transacted.

[0082] As shown in FIG. 4, computers 403, 404, and 415 may be coupled to a secure server 401 via Internet 402. Internet 402 provides the communications network that allows computers 403, 404, and 415 to communicate with secure server 401. Accordingly, computers 403, 404, and 415 may use Point-to-Point Protocol (PPP) methods to communicate with Internet 402. Moreover, client/server system 400 may support the use of a variety of

[0083] Internet protocols for data transmission. The primary protocol of Internet 402 may be a hyper-text transfer protocol (http), the protocol but underlies the World Wide Web. Http defines how messages are formatted and transmitted and what action Web servers and browser software should take in response to various commands. Most third-party browser-based software intended for messaging or commerce-based transactions recognize the http protocol. In addition, associated Web pages within client/server system 400 may be formatted and displayed in accordance with html. Html is the language that defines the structure and layout of a Web document using a variety of tags and attributes. In addition, client/server system 400 preferably specifies the use of the Extensible Markup Language (XML). XML allows Web designers to create customized tags thus enabling the definitions, transmission, validation, and interpretation of data among applications. Using such conventional inter-products communications techniques allows client/server system 400 to ensure that transformer ordering system 100 is able to communicate with a variety of third-party products.

[0084] Although FIG. 4 shows Internet 402 interconnecting computers 403, 404, and 415 with secure server 401, it should be appreciated that computers 403, 404, and 415 could be implemented with Internet 402 replaced with an alternate communications network, for example, a local area network (LAN) or a wide area network (WAN). Also, the communications network coupling quality credentials secure server 401 and computers 403, 404, and 415 may be a Public Service Telephone Network (PSTN), used in traditional telephone networks.

[0085] As shown in FIG. 4, secure server 401 may be coupled to a database 409. Database 409 may include one or more individual databases or, alternatively, may include distinct components of a single database device, such as a central database having a plurality of database partitions. Secure server 401 may be a typical computer device (as shown in FIG. 5) or a dedicated database server device. Secure server 401 may have commercially available database server software installed thereon, for example, SQL SERVER 7.0, available from MICROSOFT Corporation. Secure server 401 allows data to be sent to and retrieved from database 409. These data entries and queries may be made in response to instructions from computers 403, 404, and 415.

[0086] The database, or databases, 409 synthesize multiple pieces of new order data 410, edit order data, and order status information 411 that manufacturers and customers of transformers can use in selecting quality distribution transformers that meet the specific needs of the customer. Preferably, the one or more databases 409 allow customers of the transformer ordering system 100 to submit new order submissions 405, changes to existing orders 416, and queries regarding the status of existing orders 407 to the server 401 which can access the database 409 for the requested data and information indicative of a particular transformer specification and/or order status. Using unique ordering and design methodologies and price-adjustments, the transformer ordering system 100 represents state-of-the-art transformer design selection and ordering criteria.

[0087] Order information 405, edit information 416, and status inquiries 407 into the secure servers 401 and the database 409 can be of varying levels detail, including, for example, standard queries and custom queries. The databases 409 can also provide storage services for customer-specific design and ordering data. This feature can allow customers to share design and ordering data with the public, vendors, or other customers through the secure server 401 and database 409. This provides for unprecedented access to ordering and design data and information at the customer-specific level. Storage service for customer-ordering and design data may be provided. Preferably, access to the database 409 may be controlled by a system administrator and can be limited to authorized or registered personnel only, or alternatively, different levels of access can be available based on privileges assigned by the system administrator, for example.

[0088] Preferably, the secure server 401 includes a four-tier architecture, wherein all applications are designed with reference to an architectural model that separates the client browser, the web server, the business layer, and the database processing into layers. In this instance, computers 403, 404, and 415 may contain the programming that provides the first-tier graphical user interface (GUI) and application-specific data entry forms/reports or interactive data entry. The second-tier business logic may be located within secure server 401. The business logic acts as the server for client requests from computers 403, 404, and 415. As such, it determines what data 410 and information 411 is needed and where it is located. The third tier may include database 409 and any programming that manages read and write access to it. Because the programming for one particular tier can be changed or relocated without affecting the other tiers, the three-tier model makes it easier to continually evolve an application as new needs and opportunities arise.

[0089] To ensure scalability, the secure server 401 is preferably a stateless Web server, wherein all parts of the application running on the Web server are stateless so that standard Web server scaling technologies can be applied efficiently. A stateless Web server is appropriate for Internet-based systems because the Internet is intrinsically stateless, as each request for a new Web page is processed without any knowledge of previously requested pages. Also, secure server 401 may have an application session state to manage the Web server's application state. Application session states can be stored in a database 409 or a highly robust and scalable server component built specifically for the purpose of managing the Web application state.

[0090] It should also be appreciated that secure server 401 may serve requests using various types of protocol, depending on the type of protocol used by computers 403, 404, and 415. Moreover, although one quality credentials secure server 401 is shown in FIG. 4, it should be appreciated that

there may be many individual database server devices acting in unison to respond to the plurality of received data entries and information requests. In this instance, secure server **401** may be replicated and synchronized so that changes made to one database are reflected in all others. Replication enables many users to work with their own local copy of the database but have the database updated as if they are working on a single, centralized database. For database applications where users are geographically widely distributed, replication is often the most efficient method of database access.

[0091] In the context of transformer ordering and designing, as will be further discussed, the data and information **405, 407, 416** sent to as well as the data and information **406, 408, 417** retrieved from database **409** may include data and information indicative of transformer design specifications and operating requirements. The data entries to and information requests from database **409** may be initiated by computers **403, 404,** and **415**.

[0092] Due to sensitive nature of the proprietary and pricing data in the database **409**, secure server **401** preferably has certain security features. For example, secure server **401** may support any number of security protocols, including Secure Socket Layer (SSL). These security protocols encrypt and decrypt communications with secure server **401** to protect against third-party tampering and unwanted access.

[0093] In addition, because of the need to ensure that the proper data and information are returned to the appropriate customer (e.g., person or system) who ordered or requested it, secure server **401** may identify the source of the data. For example, secure server **401** may be capable of detecting an Internet Protocol (IP) address of computers **403, 404,** and **415**. In this way, secure server **401** may ensure that the data and/or information is sent to the customer who originated the order/request.

[0094] Computers **403, 404,** and **415** may use a browser or other "front-end" software to communicate with secure server **401** via Internet **402**. The nature of the data received by and data and/or information transmitted by the secure server **401** will vary depending on the nature of the user of the network appliance.

[0095] As shown in **FIG. 4**, customer order computer **403** may serve a purpose different than that of order status computer **404** or order edit computer **415**. While computer **404** send a requests **407** for previously submitted ordering data and information **411**, customer order computer **403** provides a mechanism for the submission **405** of ordering data and information **410** to server **401**. As a result, the flow of data and information between order computer **403** and the server **401** differs from order status computer **404**. In particular, the server **401** allows the new order computer **403** to send a submission **405** of new order-based data **405**, via Internet **402**, to the secure server **401** where the new order-based quality data **405** is received and processed by server **401**. The new order-based quality data **410** may then be stored by server **401** in database **409**. The server **401** may also communicate a response **406**, via the Internet **402**, to the submitting or new order computer **403**. The response **406** can include, for example, a verification that the new order-based data **410** has been received and/or other information or notes relating to the order. By designating certain addressing information in the initial submission or request **405**, the appropriate computer is ensured of receiving the correct response **406**. Such designation may include, for example, an IP address or an e-mail address.

[0096] Although one new order computer **403** is shown in **FIG. 4**, it should be appreciated that in practice a plurality of computers may be available to submit new order-based data **410**. In fact, using Internet **402**, or other similar distributed communications network(s), there may be as many computers as there are customers. In this case, each customer, once registered may be given a user name and corresponding password so that a submission **405** or request **407** may be conducted from any computing device. It should be appreciated that the computers **403, 404,** and **415** also may be located in any location. For example, one or more computers may be centrally located with other computers, or each computer **403, 404,** and **415** may be located at the home or place of business of the customer, or the like. Furthermore, each computer may be a portable device, like a laptop computer or personal digital assistant.

[0097] As shown in **FIG. 4**, order status computer **404** may send a status request **407**, via Internet **402**, to secure server **401**. Also, the secure server **401** may communicate a response **408**, via Internet **402**, for the requested order status data and information to the requesting computer **404**, depending on which one the request for order status data/information originated. Secure server **401** may store the order status request **407** and order status response **408** in database **409**.

[0098] Upon receiving the order status response **408**, containing, for example, previously order-based quality data **411**, the user of the order status computer **404** can obtain status informed regarding a previous order.

[0099] New order-based data **410** may be entered to or existing order status information **411** communicated from secure server **401** using any number of methods. For example, order status computer **404** may enter order status request **407** using an html browser-based document. Using such a document, order status computer **404** presents the user with a GUI that facilitates the entry of the data related to the desired order using freely entered alphanumeric text, pull-down menu options, and/or predefined selection buttons (not shown). Alternatively, where order status computer **404** is a wireless handheld device, a user may enter existing order status request **407** using a wireless application, as understood by those skilled in the art.

[0100] Change/edit order computer **415** sends a change order request **416** through Internet **402** to server **401**. The existing order information is accessed from database **409** and the change is stored back into the database. Preferably, the server **401** sends a change order response **417** back to computer **415** for the user.

[0101] In any case, the various requests **405, 407, 416** and the various responses **406, 408, 417** may contain various combinations of inputted characters and predefined selection options. It should also be appreciated that order requests and order responses may also include non-alphanumeric graphic based entities, including but not limited to bit-mapped graphic images.

[0102] Preferably, the transformer ordering system **100** is enabled via the Internet and secure server **401** is coupled to

Internet **402** through one or more interface connections to receive the order-based data and also to provide access to the order-based information previously entered and stored in database **409**

[0103] Although **FIG. 4** shows the invention in the context of the Internet, it should be appreciated that the invention may also be used in the context of an Intranet. Specifically, all elements shown in **FIG. 4** may be a part of a singly-owned network of computers and database components that span one facility or a network of facilities, common in the customer context. In this way, a single customer, or a coalition of vendors, may create their own database of transformer ordering data and information from sources exclusively within their own facilities. This would be especially relevant where the Intranet was owned by a power equipment company, responsible for designing and manufacturing a variety of transformers on a daily basis.

[0104] Exemplary Computing Environment

[0105] **FIG. 5** is a block diagram providing a brief description of a suitable computing device. This computing device may be typical of computers **403**, **404**, and **415**, and/or secure server **401**. While the invention will be described in the general context of computer-executable instructions of a computer program that runs on a personal computer, those skilled in the art will recognize that the invention also may be implemented in combination with other program modules. Generally, program modules include routines, programs, components, data structures, etc. that perform particular tasks or implement particular abstract data types. Moreover, those skilled in the art will appreciate that the invention may be practiced with other computer system configurations, including hand-held devices, multiprocessor systems, microprocessor-based or programmable consumer electronics, minicomputers, mainframe computers, and the like.

[0106] With reference to **FIG. 5**, computers **403**, **404**, and **415** and/or secure server **401** may be conventional personal computer **500**, including a processing unit **501**, a system memory **502**, and a system bus **503** that couples various system components including the system memory **502** to processing unit **501**. Processing unit **501** may be any of various commercially available processors. Dual microprocessors and other multiprocessor architectures also can be used as processing unit **501**.

[0107] System bus **503** may be any of several types of bus structure including a memory bus or memory controller, a peripheral bus, and a local bus using any of a variety of conventional bus architectures. System memory **502** can include read only memory (ROM) **504** and random access memory (RAM) **505**. A basic input/output system (BIOS), containing the basic routines that help to transfer information between elements within personal computer **500**, such as during start-up, can be stored in ROM **504**.

[0108] Personal computer **500** further includes a hard disk drive **507** and a magnetic disk drive **508** to read from or write to one or more of a removable disk **509**, and an optical disk drive **510** to read a CD-ROM disk **511**, or to read from or write to other optical media. Hard disk drive **507**, magnetic disk drive **508**, and optical disk drive **510** can be connected to system bus **503** by a hard disk drive interface **512**, a magnetic disk drive interface **513**, and an optical drive interface **514**, respectively. The drives and their associated computer-readable media provide nonvolatile storage of data, data structures, computer-executable instructions, etc. for personal computer **500**. Although the description of computer-readable media above refers to a hard disk, a removable magnetic disk and a CD, it should be appreciated by those skilled in the art that other types of media which are readable by a computer, such as magnetic cassettes, flash memory cards, digital video disks, Bernoulli cartridges, and the like, may also be used in the operating environment.

[0109] A number of program modules may be stored in the drives and RAM **505**, including an operating system **515**, one or more application programs **516**, other program modules **517**, and program data **518**.

[0110] A user may enter commands and information into personal computer **500** through one or more input devices, such as a keyboard **520** and a mouse **522**. Other input devices (not shown) may include a microphone, joystick, game pad, satellite dish, scanner, or the like. These and other input devices are often connected to processing unit **501** through a serial port interface **526** that is coupled to system bus **503**, but may be connected by other interfaces, such as a parallel port, game port or a universal serial bus (USB). A monitor **527** or other type of display device is also connected to system bus **503** via an interface, such as a video adapter **528**. In addition to monitor **527**, personal computers typically include other peripheral output devices (not shown), such as speakers and printers.

[0111] Personal computer **500** may operate in a networked environment using logical connections including a local area network (LAN) **531** and a wide area network (WAN) **532**. Such networking environments are commonplace in offices, enterprise-wide computer networks, Intranet and the Internet. When used in a LAN networking environment, personal computer **500** is connected to LAN **531** through a network interface or adapter **533**. When used in a WAN networking environment, personal computer **500** typically includes a modem **534** or other means for establishing communications over wide area network **532**, such as the Internet. Modem **534** is connected to system bus **503** via serial port interface **526**. It will be appreciated that the network connections shown are one example, and that other means of establishing a communications link between the computers may be used.

[0112] In accordance with the practices of persons skilled in the art of computer programming, the present invention is described below with reference to acts and symbolic representations of operations that are performed by the personal computer **500**, unless indicated otherwise. Such acts and operations are sometimes referred to as being computer-executed. It will be appreciated that the acts and symbolically represented operations include the manipulation by the processing unit **501** of electrical signals representing data bits which causes a resulting transformation or reduction of the electrical signal representation, and the maintenance of data bits at memory locations in the memory system (including the system memory **502**, hard drive **507**, floppy disks **509**, and CD-ROM **511**) to thereby reconfigure or otherwise alter the computer system's operation, as well as other processing of signals. The memory locations where data bits are maintained are physical locations that have particular electrical, magnetic, or optical properties corresponding to the data bits.

[0113] The following is a general description of the operation of an exemplary network based system **100** for the on-line design of distribution transformers.

[0114] **FIG. 6** shows an exemplary Login Screen **600**. As shown in **FIG. 6**, to begin using the system software (not shown), a user (e.g., a customer) logs into the on-line system **100** by entering an User ID in the User ID field **601** provided. The user can tab to the Password field **602** and enter his or her password. The password is preferably set when the User ID is assigned. For security reasons when a user enters his or her password in the text box, the entry is not displayed on the screen. Passwords can consist of any combination of keyboard characters. The first character of the password is preferably an alphanumeric character. If a user needs to change his or her password, then he or she can use the maintenance button to perform this function.

[0115] If the user wishes to operate the system using the English language function, then he or she leaves the language selection set to English in language selection field **603**, which is preferably the default setting. Preferably the on-line design system **100** includes a language dictionary that has been fully populated with the necessary terms. The user can click on the Enter button **604** to move to the next screen.

[0116] **FIG. 7** shows the next screen, which is the RFQ (Request For Quote) Search Screen **605**. As shown in **FIG. 7**, the RFQ Search screen **605** allows the user to search for an RFQ that has already been entered into the transformer ordering system **100** or allows the user to initiate a new RFQ. The following section describes an exemplary process for searching for existing RFQ's. An exemplary process for creating new RFQ's is described after the section describing how to search for existing RFQ's.

[0117] Additional buttons **606, 607** at the top of the RFQ search screen **605** allow the user additional functionality. For example, the Log Out button **606** takes the user back to the first Log In screen **600**. The Maintenance button **607**, available to those with system maintenance privileges, takes the user to the system maintenance functions described in detail below.

[0118] A user can search for an RFQ by entering information in one or more of the Customer Name field **608**, Customer RFQ Number Field **609**, Manufacturer Number field **610**, User Reference field **611**, Contact Name field **612**, and/or Date field **613**. When using any of these fields other than the date fields, the usr may enter either a complete value or use a wild card character. The date fields **613** will not accept the wild card characters. Preferably, the system is setup such that the manufacturer number field **610** and the date field **613** are automatically filled in, so the usefulness of searching the rest of the fields will depend on the rigor that the users apply in completing them.

[0119] The * is used for wild card searches. For example, if a user decides to search for an RFQ using the manufacturer number and only remember the first few numeric values, a user might enter RATH028* to find all RFQs beginning with "RATH028."

[0120] The search can also be narrowed by date by entering a Starting and Ending Date. Dates are preferably entered in the DD/MM/YYYY format or by using a calendar function, which is preferably available by clicking on the three dots on the buttons **614** to the right of these fields, as shown in **FIG. 7**.

[0121] The user may change the Month or Year using a popup or drop-down box (not shown) by making a selection. To move the date forward from the currently highlighted date, the user may enter the number of, for example, weeks in the box to the right of the date and toggle up to change the date. The calendar will preferably move to the appropriate month and day that corresponds to the number of weeks that the user has entered. The user may also click on a day for the currently displayed month. Once the user has selected the correct date, he or she may click on the Close button (not shown) to close the date drop-down box. The date will be entered into the date field **613** from which the user accessed the calendar.

[0122] The user may also search by customer. If the user clicks on the three dots on the button **615** to the right of the Customer name field **608**, the Choose Customer screen **620** is displayed, as shown in **FIG. 8A**.

[0123] The user may click on the list box button for the top field **621** and select a desired customer if they are one of most recent with whom the user has been working on an RFQ. If the customer is not in this list, the user may enter a name or part of a name followed by the wild card character (*) into the Search field **622** and click on the Go button **623**.

[0124] After a few seconds, the Search Results screen **624** is displayed, as shown in **FIG. 8B**. The user may use the list box indicator and the scroll bar at the right of the list to scroll through and select the customer that the user is seeking.

[0125] The user may then click on the desired customer and the system returns to the RFQ Search screen **605** with the customer filled in the appropriate field. If the user needs to load a new customer, he or she may use the maintenance button **607**.

[0126] Once the user has entered his or her search criteria, then he or she may click on the Find button **616**. The RFQ Results screen **630** is displayed, as shown in **FIG. 9**, with one or more RFQs that match the user's request. If none match the search criteria, a screen (not shown) will be displayed which informs the user of this.

[0127] If the user prefers to see only the RFQs without details (items), he or she may click on the Hide Lines button **631**, shown in **FIG. 9**. If the details (items) are being hidden from the user, the caption on the Hide Lines button **631** becomes "Show Lines." Clicking on the Show Lines button **631** will redisplay the details (items). The user may also return to the Search Screen **605** by clicking on the Home button **632**. The user may recall details on any of the RFQ's shown in this summary by clicking an appropriate buttons on each of the negotiations. The user may continue adding items to an RFQ at this time by clicking on the Add button **633**. Details of the function of the Add button are discussed in more detail under the Shopping Cart section. An RFQ may be edited by clicking on the edit button **634**.

[0128] The following section discusses an exemplary process for creating a new RFQ. Referring back to **FIG. 7**, to create a new RFQ, the user clicks on the New RFQ button **617** on the RFQ Search screen **605**.

[0129] A Choose a Customer Screen **620** will be displayed, such as that shown in **FIG. 8A**. As shown in **FIG. 8B**, the user is prompted to choose a customer from the Choose a Customer screen **620**. The user clicks on the drop down box button **626** from the top field and selects a desired customer if the customer is one of the most recent for whom the user has been working on an RFQ.

[0130] If the desired customer is not in this list, then the user may enter the customer's name or part of the customer's name followed by an * and click on the Go button **623** next to the Search field **622**.

[0131] Next, the Choose a Customer screen **624**, similar to the screen shown in **FIG. 9**, is displayed. The user may click on the drop down box and may use the scroll bar at the right of the list to move down through and select the customer he or she is seeking. The user clicks on the desired customer to complete the customer selection.

[0132] **FIGS. 9 and 10** show an exemplary Ship To screen **640** that is displayed next.

[0133] As shown, the RFQ number is displayed at the top of the screen in field **641**.

[0134] The shipping information box **642** to the right contains the basic customer shipping information. The user can click on the drop-down box **643** next to the Ship To field **641** to select an address that is currently in the database. If the desired address is not in the database, the user can fill in the Ship To screen **640** manually. If the address is added manually, the new address can be saved in the database for later use by checking the Add to Ship To's box **644**.

[0135] As shown in **FIG. 10**, there is a series of buttons displayed at the bottom of the screen **640**. The General button **645**, Terms button **646**, Notes button **647**, and Next button **648** are displayed.

[0136] The user may click on the General button **645** of the Ship To screen **640** to bring up the General screen **650** to enter information about this customer's RFQ. **FIG. 11** shows an exemplary General Customer Information Screen **650**. RFQ types **651** can include, for example, Standalone, Blanket, Estimate, Future Business, Missing Business, RMR, and the like.

[0137] Customer RFQ **652** is a customer assigned number for the negotiation and is recorded, if known, for the purpose of further searches. User Reference **653**, Project Name **654**, and End User Name **655** are free-text fields. The End User Type **656** and drop down box allows the user to assign a type of business to each customer. End Destination **657** refers to the location (e.g., country) where the order will be shipped. The remaining fields include date fields **658** for different activities in the RFQ process. When the user has completed this screen, he or she may click on the Save/Close button **659** and the information is saved to a database. The Ship To screen **640** (**FIG. 10**) is displayed again.

[0138] **FIG. 12** shows an exemplary Customer Terms screen **660**. As shown in **FIG. 12**, the Customer Terms screen **660** is used to enter information about terms of the sale. Preferably, the user may use drop down boxes for all fields (e.g., payment terms field **661**, condition of sale **662**, terms basis **663**, freight payment terms **664**, freight code **665**, and liability point **666**) except the Terms Detail box **667** that is provided to type in free-form text. Preferably, the default Payment Terms is Net **30** and the default Freight Code is Freight on Board (FOB). Preferably, the Terms Basis is as early as possible, usually meaning the Date of Invoice.

[0139] When the user has completed this screen, he or she may click on the Save/Close button **668** and the information is saved to the database. The Ship To screen **640** is displayed again.

[0140] **FIG. 13A** shows an exemplary Notes Summary Screen **670**. As shown in **FIG. 13A**, the Notes Summary screen **670** is used to attach notes to the RFQ. As shown in the category box **671**, these may be categorized into different types related to each of the stages in completing the order, such as, for example: General, Shipping, Packing, Invoicing, Marking Instructions and Internal. Internal notes are preferably not printed on customer correspondence.

[0141] The user may click in the appropriate check box of category box **671** to select the type of note he or she wishes to add to the RFQ. Many of the necessary notes could already be stored in the database such that the user simply clicks the Import button **672** to access and import the desired notes. The Imported Notes screen **675** is displayed to the user for the selected category.

[0142] **FIG. 13B** shows an exemplary Imported Notes screen **675** for the General category. As shown in **FIG. 13B**, the user can use the scroll bar **676** on the right to scroll down to see all notes. The user may select notes by clicking in the check box **677** next to the note or by typing the numbers, separated by commas, in the field **678** at-the upper left.

[0143] After completing a selection, the user clicks on the Import button **679**. The Notes Summary screen **670** is again displayed with the notes that the user has selected for that category. The user may review the notes by selecting the note numbers in the drop down box **673** in the upper left corner of the screen. The user may add a New Note using the same drop down box.

[0144] **FIG. 13A** shows an exemplary Note Summary Screen. Once the user has completed selecting and reviewing notes for each category, he or she may click on the Save/Close button **680** and the information is saved to the database. The Ship To screen **640** (**FIG. 10**) is displayed again. The user then clicks on the Next button **648** on the Ship To screen **640**. The Shopping Cart screen **685** is displayed.

[0145] **FIG. 14A** shows an exemplary Shopping cart screen **690** where the user creates the RFQ by adding items. As shown in **FIG. 14A**, there is a Home button **691** and a Hide Lines button **692** to the left of the RFQ number.

[0146] The Edit button **693** and Print button **694** above the line items operate for the whole RFQ. The Edit button allows the user to change information about the customer and the RFQ in general, such as terms or notes. Print will create a copy of the RFQ and download or print it. To work with line items use the Add button **695** to create and (after creation) the Edit buttons **696** at the left of the line item area of the screen. When the Shopping Cart is first displayed it contains no items.

[0147] To add an item, the user clicks on the Add button **695** at the left of the Shopping Cart screen, next to the Status box. The Line Item screen **697** is displayed, as shown in **FIG. 14B**. Certain fields, such as the Item Type **698**,

Quantity **699**, Latest Delivery Date **703**, and Manufacturer Negotiator **701**, may be required fields.

[0148] **FIG. 14B** shows an exemplary Line Item Screen **697**. In one exemplary embodiment, the user may select "PAD: 316—1ph Pad-mount Transformer—Athens, Ga." as the Item Type. Next, the user may enter the Quantity for the items. The user may be required to fill in the Latest Delivery Date and the Manufacturer Negotiator name. This is the person at the manufacturer who is responsible for the quotation and is usually the person filling in the RFQ.

[0149] The user may optionally enter a product ID in Product ID **702**, if it is known. But, the preferred handling of the Product ID field is to leave this field blank and allow the system to assign an appropriate product ID. The Earliest Delivery Date field **704** is also optional. If the user knows this information then he or she may enter the Customer Line **705** and Customer Product ID **700**. The Description field **706** is preferably a free text box that may be completed by the system.

[0150] The Notes button **707** accesses the same notes information discussed previously in the Ship To section under the Notes. These notes will refer to the specific item. When the user has finished entering information in the Notes, he or she clicks on the Save/Close button on the Notes screen and the Line Item screen **690** is displayed again.

[0151] When all information about an item has been completed, it is time to design the item. The user clicks on the Next button # to initiate the design process. The Design Creation is the next important step in completing an RFQ.

[0152] FIGS. **15-20** and the following description show how to create an exemplary Single Phase Pad-mount Transformer design. The first section will detail how to use one manufacturer specification that has been verified and entered into the transformer ordering system. A short section following will quickly describe how other specifications may differ.

[0153] The Customer Specification screen **710** is used to select which specification will be used to design the item. **FIG. 15A** shows an exemplary Design Specification Screen **710**. As shown in **FIG. 15A**, the user my use the drop down box **711** to select one of the options as a specification for design. Various manufacturer design specifications are the standard and others can be added as they become available for specific customers when they have been completely verified and loaded.

[0154] The user may select the desired manufacturer specification, such as a transformer specification manufactured by ABB Power T&D Co., Inc. This option will start the Accessories. **FIG. 15B** shows an exemplary Design Accessories screen **712**. As shown in **FIG. 15B**, the Accessories screen **712** is used to identify which accessories to add to the basic transformer, such as HV Well Bushing option **713**, HV Fuse option **714**, HV Bushing Insert option **715**, LV Terminals option **716**, Ground Terminals option **717**, Cabinet Material option **718**, and the like. The user may use the drop down boxes to select an option if the one shown is not what he or she wants. When the user has completed this screen, he or she may click on the Continue button **719**.

[0155] **FIG. 16** shows an exemplary Ratings screen **720** which can be used to select the ratings for the transformer that the user wants. The user may use pull down boxes to select the configuration for the item. The Ratings screen may include selections for the appropriate configuration, such as a power field **721**, a frequency field **722**, a high voltage rating field **723**, a low voltage rating field **724**, a loss evaluation field **725**, and a configuration field **726**. Preferably, the high voltage ratings and kVA's shown on this screen will be only those that are approved for the particular customer specification that has been selected.

[0156] After selecting the appropriate configuration, the user may click on the Full Design button **727** to configure the desired transformer. This process will complete a bill of materials, selecting a core and coil from a sorted list satisfying these specified ratings. The list is sorted by Total Owning Cost (TOC) for candidate core and coil designs using the No Load and Load Loss evaluation fields. Preferably, the process automatically selects the lowest TOC. A dialog box (not shown) will ask the user to wait while the design is completed. After selecting this option, the Bill of Materials screen **735** is displayed, as shown in **FIG. 18**.

[0157] Alternatively, the user may click on the Select Core and Coil button **728** if he or she wants to review the sorted list of core and coil designs. The user then has the opportunity to select the core and coil assembly that he or she wants. The Select Core and Coil screen **730** is displayed.

[0158] **FIG. 17** shows an exemplary Select Core and Coil screen **730**. As shown in **FIG. 17**, this screen displays a sorted listing of core and coil options in field **731**. To see more of the data for each row, the user may click on the >> button **732**. To move back to the left, the usr may click on the << button **733**. The PG DN and PG UP buttons **734**, **735** enable the user to look at more entries further down in the table and then to move back up, one page at a time.

[0159] The user may click on the Radio button **736** next to the item that represents the Core and Coil he or she wants to use. A dialog box (not shown) will ask the user to wait while the design is completed. After selecting this option, the Bill of Materials screen **740** is displayed.

[0160] **FIG. 18** shows an exemplary Bill of Material screen **740**. As shown in **FIG. 18**, the Bill of Material (BOM) shown in field **741** is for an exemplary manufacturer specification by ABB Power T&D Co., Inc. and includes the Jspec (item) **742**, a description **743**, and a quantity **744**. This information is preferably for internal use only. The user may review the BOM and then click on the button at the bottom of the screen (not shown). The button is labeled View Design if the user is coming from the Select Core and Coil option and is labeled Publish Design if the user is coming from the Full Design option.

[0161] After clicking on the View Design button, the External View of RFQ (or Publish) screen **750** is displayed. **FIG. 19A** shows the top portion of one such screen **750a** This is the format and content of the data that will be added to the full negotiation data once the item is added to the shopping cart. The top portion of the Published Design screen **750a** includes the following fields: quantity **751**, product ID **752**, unit price **753**, total price **754**, additional information **755**, and information from the customer specification **756** (if this information is available). A button **757** is provided to add the item to the RFQ.

[0162] Preferably, the Unit Price textbox **753**, the Full Cost value **758** and the Over Ride button **759** are visible and

BOM

available only to those users authorized to see the cost and to modify pricing. For those with this authority, the user may change and store a new unit price. The Over Ride button **759** saves a change to the price entered in the box to the left and changes the value in the Total Price field **754**. Pressing the Over Ride button **759** also causes the full cost model to recalculate the full cost. **FIG. 19B** shows the bottom portion of this item description, including specification field **756**. A portion of the Published Design screen **750** with additional specifications between these is not shown.

[0163] If the user wants to create outline drawings in, for example, AutoCAD Release **14** format, then he or she may click on the Create a CAD drawing (DWG) of his or her design button **760**, as shown in **FIG. 19B**. This creates the outline drawing on the server and offers the user the opportunity to download the drawing to their local machine. Downloading the file to the user's local machine allows the user to attach and send the file with the RFQ between the manufacturer and the customer. In this embodiment, the file is in AutoCAD "*.dwg" format. Normal AutoCAD viewers, including AutoCAD itself, will be capable of opening and viewing this file.

[0164] When the user has finished working with this screen, he or she may click on the Click here to Add item to RFQ button **757** to add this item to the RFQ. The screen will notify the user of this process while returning him or her to the Shopping Cart screen **690** (**FIG. 14A**) where the user should see the addition of this item. This page may be printed by right clicking the mouse and selecting Print from the resulting menu (not shown).

[0165] Selecting a specification other than a loaded and verified manufacturer specification (e.g., a non-ABB specification) bypasses the Accessories screen **712** (**FIG. 15B**) and displays the alternate Specification Ratings screen **720***a* As shown in **FIG. 20**, this screen **720***a* is identical to the Ratings screen **720** for the ABB specifications (**FIG. 16**) except that it contains an extra drop down box **770** which allows the user to select from the specification, revision, and transformer types defined in the specifications loaded for this customer. The user may click on the drop down box **770** to select the desired specification. From this point the process is the same. The user selects Full Design or selects Core and Coil, reviews the Bill of Materials, publishes the design and adds the item to the shopping cart, pausing first to create outline drawings if he or she so desires.

[0166] To Edit a Line item, the user may return to the Shopping Cart screen **690** (**FIG. 14A**) and clicks on the Edit button **634** next to the item to be edited. The Line Item screen **697** (**FIG. 14B**) is populated and displayed with all of the data previously entered for this item. Any of the information may be changed. The user edits the desired entry by following the same process as for adding an item and by making sure to remember to click on the Click here to Add item to RFQ button **757** on the Published Design screen **750** to finish the item.

[0167] The original (e.g., old) version of the item is removed from the database upon leaving the Shopping Cart screens. The item is completed and returned to the shopping cart in order to properly replace all of the data.

[0168] **FIG. 21** shows an exemplary Maintenance screen **780**. As shown in **FIG. 21**, the Maintenance screen **780** is displayed when the user presses the maintenance button **607** on the RFQ search screen **605** (see **FIG. 7**) at the beginning of the process. This screen enables the user with sufficient permission levels to accomplish certain types of system maintenance. For example, these functions may include adding or editing customer data, adding or editing Manufactures, adding or editing users, etc.

[0169] The Customer data can be located using the same search process that was discussed in the section on Searching for an RFQ. Care should be used in adding new customers to assure that the data is correct, particularly the DUNS number. The DUNS number is used as an index to several tables. Once entered, the DUNS number is the one field that preferably can not be edited. As shown in **FIG. 21**, the Maintenance screen **780** includes an authorized user field **782**, a password button **783**, a tables button **784**, a choose a customer field **785**, a manufacturer or divisions field **786**, and a users field **787**.

[0170] **FIG. 22** shows an exemplary Rating screen **720***b*, which is similar to the Ratings screen **720** of **FIG. 16**, with the Loss Evaluation field **725** filled-in. The loss evaluation criteria are used to sort multiple designs by the sum of the first cost plus the cost of the losses evaluated over the life of the transformer. The formula looks like:

$$TOC = \text{First Cost} + (NLEvaluation * NL \text{ Losses}) + (LLEvaluation * \text{Load Losses})$$

[0171] The NL evaluation value, in Dollars per Watt, is retrieved directly from the screen. The LL evaluation value is also retrieved directly from the screen. As shown in **FIG. 22**, input values of $3.00 for the NL field **788** and $0.65 for the LL field **789** are illustrated The losses are retrieved from the database for each of the Core/Coil designs being evaluated. Specifically, for the embodiment shown, the system retrieves the no load loss and load loss values for the single voltage designs. The calculations are performed and the data is displayed on the selection form, as shown in **FIG. 23**.

[0172] The "First Cost" term in the above equation is simply the cost of the transformer. This may be the full selling price of the transformer if the user is trying to mimic the ultimate customer or it may be some fraction of the selling price. For the Core/Coil Selection screen **790**, **FIG. 23**, the First Cost term is only a portion of the total selling price. As shown the Core/Coil Selection screen **790** includes a Total Evaluated Cost (TOC) filed **792**, a Unit Cost field **793**, a Maximum field **794**, a BandWidth field **795**, and a DeltaToc field **796**. Toggle buttons **797** are also provided for moving left and right, and up and down in the Core/Coil Selection screen **790**. In the embodiment shown, an assumption has been made that the values not included in this term on this screen are constants for all of the designs being evaluated. This of course is only an approximation, but is generally acceptable for this purpose.

[0173] The "First Cost" term that shows the select coil and core field **791** on the Core/Coil Selection screen **790** is "UnitCost" field **793** which is actually the sum of the 9 cost fields in the LWCT database. These terms may include:

[0174] HVCOST: The HV conductor cost. This field should be quite accurate

[0175] LVCOST: The LV conductor cost. This field should be quite accurate.

[0176] INSDTCST The cost of the insulation and duct materials. In LWCT, this is an approximation. The LWCT program does not track the ordering details or the cost of all of the insulation parts and pieces. The value is small compared to the other cost numbers, so the approximation is probably acceptable.

[0177] CLABRCST: The coil labor cost. This value is still under evaluation for both the core-form lines and TXF. The costing rate, retrieved directly from Symix, for the TXF line is also an approximation, but it will match the Symix costing rate at the time of the design.

[0178] CORECOST: This core cost should also be accurate.

[0179] OILCOST: The oil volume is calculated in LWCT as the raw tank volume minus the displacement of the HV conductor, LV conductor, and insulation. It should be close to a real value, although the design program will recalculate it once the actual tank has been designed or selected, and the displacement of all of the components have been taken into account.

[0180] TANKCOST: This is an approximation. The optimization process has a tank table which provides a tank cost value. This cost value must represent all tanks of that size, regardless of the accessories. Of course, any accessory cost not represented here should be constant for all of the designs being considered and should not affect the sorting of the displayed c/c designs.

[0181] MISLABOR: This includes any cost for miscellaneous labor.

[0182] MISCMATL: This includes any cost for miscellaneous materials.

[0183] As shown in **FIG. 23**, the "unit cost" data shown on the Core/Coil selection screen **790** is the data from the LWCT program. This data is used to sort the available core/coil designs It is not generally considered to be the actual cost of the unit Just as the EVAL costs in the system are only approximations, and, for EVAL, don't even include estimates for the tank and oil costs, here these core/coil costs are only approximations of the total bill of material. They are shown only to allow the user to make tradeoffs between the approximated first cost and the evaluated losses.

[0184] Occasionally, radically different designs result in similar TOC values but vary dramatically in first cost. On those occasions, the user may want to choose the design that results in the lower first cost. For the TXF process, at least for this embodiment, the few core/coil designs should be carefully chosen. Any radical swings in first cost and TOC can therefore be eliminated. The value of using this core/coil selection screen has been significantly reduced, and could be eliminated entirely if the user was not interested in playing with the small differences that might occur between the few choices.

[0185] Once the Core/Coil selection is complete, the bill of material can be accumulated and displayed. **FIG. 24** shows an exemplary Bill of Material screen **800** (as shown, cost data is a hidden column). The cost data for each "J-spec" (item) **801** is also accumulated along with the bill of material that is displayed on the Bill of Material screen **800**. A description field **802** and quantity field **803** are also provided. Note that here the costs are only the cost for each of the individual items, or J-specs (item). These J-spec costs accumulate the material, labor and overhead costs of each of the parts listed under each of the J-specs (item). In this example, this summation process results in:

Matlcost	Labor	Ovhd	Total
431.66	23.54	31.84	487.04

[0186] This bill of material screen for the above embodiment does not accumulate any of the assembly labor to put the J-specs (item) together. Nor does the user get the opportunity to see the details of this labor analysis, but the full cost model does include the following assembly labor costs for the finished transformer.

Workcenter	Run Time	Labor rate $/hour	Labor Cost
253-10	0.0054	24.82	0.134028005
256-20	0.15	24.82	3.723
256-30	1.09	24.82	27.0538
256-40	0.98	24.82	24.3236
256-50	0.17	24.82	4.2194
256-60	0.25	24.82	6.205
		Sum	65.65882801

[0187] Thus, for this example, the bill of material cost would accumulate to $487. The final assembly labor would add another $66, for a total of $553. The full cost calculations would then inflate this value further to $692 after adding in the G&A costs, the shipping costs, depreciation and other expenses. **FIG. 25** shows an exemplary Pricing screen **805** for the above example. As shown, the Pricing screen **805** includes the quantity **806**, the Product ID **807**. The Unit Price **808**, the Total Price **809**, a button **810** to add the RFQ to the shopping cart, as well as a field **811** for additional information about the RFQ.

[0188] It is to be understood, however, that even in numerous characteristics and advantages of the present invention have been set forth in the foregoing description, together with details of the structure and function of the invention, the disclosure is illustrative only, and changes may be made to detail, especially in matters of shape, size and arrangement of parts within the principles of the invention to the full extent indicated by the broad general meaning of the terms in which the appended claims are expressed.

What is claimed is:

1. A system for facilitating the on-line configuration and pricing of a distribution transformer, between one or more users and one or more manufacturers of transformers, over a network capable of providing communications between said one or more manufacturers and one or more user sites associated with each user, said user site including an input device and a display device, said system comprising:

a system server;

a web site coupled to said server and accessible from said one or more user sites via said network;

a database for storing transformer manufacturer design data for use by a user in designing a transformer to specific design requirements and for storing transformer pricing data for use in producing a price quotation based on a transformer design designated by said user;

a display means on said web site for causing transformer design data of at least one of said one or more manufacturers to be represented on said display device;

a product configuration means on said web site for use by said user in designing a transformer by selecting said transformer design data displayed by said display means using said input device to configure said transformer;

a product description means on said web site for displaying to said user a product description resulting from product configuration means, said product description including a calculated performance characteristics and a list of mechanical and electrical features; and

a pricing means on said web site for calculating a price of said transformer designed by said user, wherein said calculated price and said product description are displayed to said user on said display device via said web site.

2. The system of claim 1, further comprising a product ordering means on said web site for use by said user in entering an order for said transformer using said input device after reviewing said product description and said calculated price of said transformer.

3. The system of claim 2, wherein said order for said transformer is received by said server and forwarded to said selected manufacturer for manufacturing of said transformer in accordance with said product description.

4. The system of claim 1, wherein said database further stores customer identification information indicative of a customer's identity, location, and billing policy, wherein said user can access said customer identification information in said database and make a single selection via said web site which thereby incorporates all of said customer identification information into said order.

5. The system of claim 1, wherein said product configuration means further comprises a form-based menu and said design specification data represented on said display device further comprises one or more of predefined product specification data and a selection of options from a predefined set of choices that are accessible via said form-based menu using said input device.

6. The system of claim 5, wherein selection of one of said predefined product specification data results in incorporation of all of said manufacturing design specification data into said product description and said product pricing.

7. The system of claim 1, wherein said system further comprises an order editing means for use by said user in changing a previously entered transformer order via said web site using said input device.

8. The system of claim 1, wherein said wherein said system further comprises an order statusing means for use by said user in accessing said system to obtain a status of a previously entered transformer order at said display device.

9. The system of claim 1, further comprising a manufacturing bill of materials generated by said product configuration means.

10. The system of claim 1, wherein said system further comprises a shopping cart means for use by said user in adding one or more ordered items to said shopping cart.

11. The system of claim 1, wherein said shopping cart means further comprises an upper level displayed to said user on said display device and a lower level which is not displayed to said user at said display device, said upper level comprising a price, a quantity, a product identification number, and a delivery lead-time of said designed transformer, and said lower level comprising a bill of materials and mechanical and electrical performance data specific to said designed transformer.

12. The system of claim 1, further comprising a drawing development means on said web site for creating drawings on said server depicting said designed transformer.

13. The system of claim 12, wherein said drawings can be downloaded to said remote user site and can be communicated to said manufacturer of said designed transformer.

14. The system of claim 1, wherein said product pricing means further comprises a cost associates with a bill of materials, a manufacturing cost, and a suggested selling price for said transformer configured by said user.

15. A method for creating an on-line request for quote for a distribution transformer comprising the steps:

providing a server accessible by a user from a remote location for receiving a request for quote from said user, receiving customer data into said server;

receiving ship to information for said customer into said server;

providing terms relating to terms of sale for selection by said user relating to said request for quote;

providing notes relating to different stages in completing said request for vote for selection by said user for attachment to said request for quote;

providing a shopping cart to which said user may add one or more items selected for said request for quote;

providing a designing server accessible by said user from a remote location for designing a transformer in accordance with said request for quote;

providing one or more manufacturer design specifications for use by said user in designing said transformer;

generating a bill of materials and a transformer description in accordance with said request for quote for said designed transformer, calculating a manufacturing cost for said transformer based on said bill of materials; and

displaying said customer request for quote at said remote location.

16. The method of claim 15, further comprising the step of receiving an order from said user for said transformer into said server.

17. The method of claim 16, further comprising the step of forwarding said order for said transformer from said server to a manufacturer of transformers for manufacturing of said transformer in accordance with said bill of materials and said transformer description.

18. The method of claim 15, wherein said request for quote received from said user comprises one of a new request for quote and an existing request for quote previously entered into said server.

19. The method of claim 15, wherein said method further comprises the step of creating drawings on said server based of said bill of materials and a transformer description, said drawings being adapted for download to said user's remote location and for attachment to said request for quote.

20. The method of claim 15, wherein said step of providing a designing server accessible by a user from a remote location for designing a transformer further comprises designing and defining items according to predetermined manufacturing specifications including adding accessories and optionally selecting a core and coil.

21. The method of claim 15, further comprising the step of storing said customer data and said transformer manufacturer design data in a database that is accessibly from said server for use by said user in completing said on-line request for quote for said transformer.

22. The method of claim 15, further comprising the step of checking a status of a previously submitted request for quote from said remote location.

23. The method of claim 15, wherein said step of providing a designing server further comprises the steps of providing a first parts selection menu for use by said user in selecting internal accessory parts independent of said core and coil, providing a menu for selecting a coil and coil, and providing a second parts selection menu for use by said user in selecting external parts for packaging said core and coil.

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